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# Transbay Program Final EIS Reevaluation

Updating the Transbay Program 2004 Final EIS for Adoption by the Federal Railroad Administration

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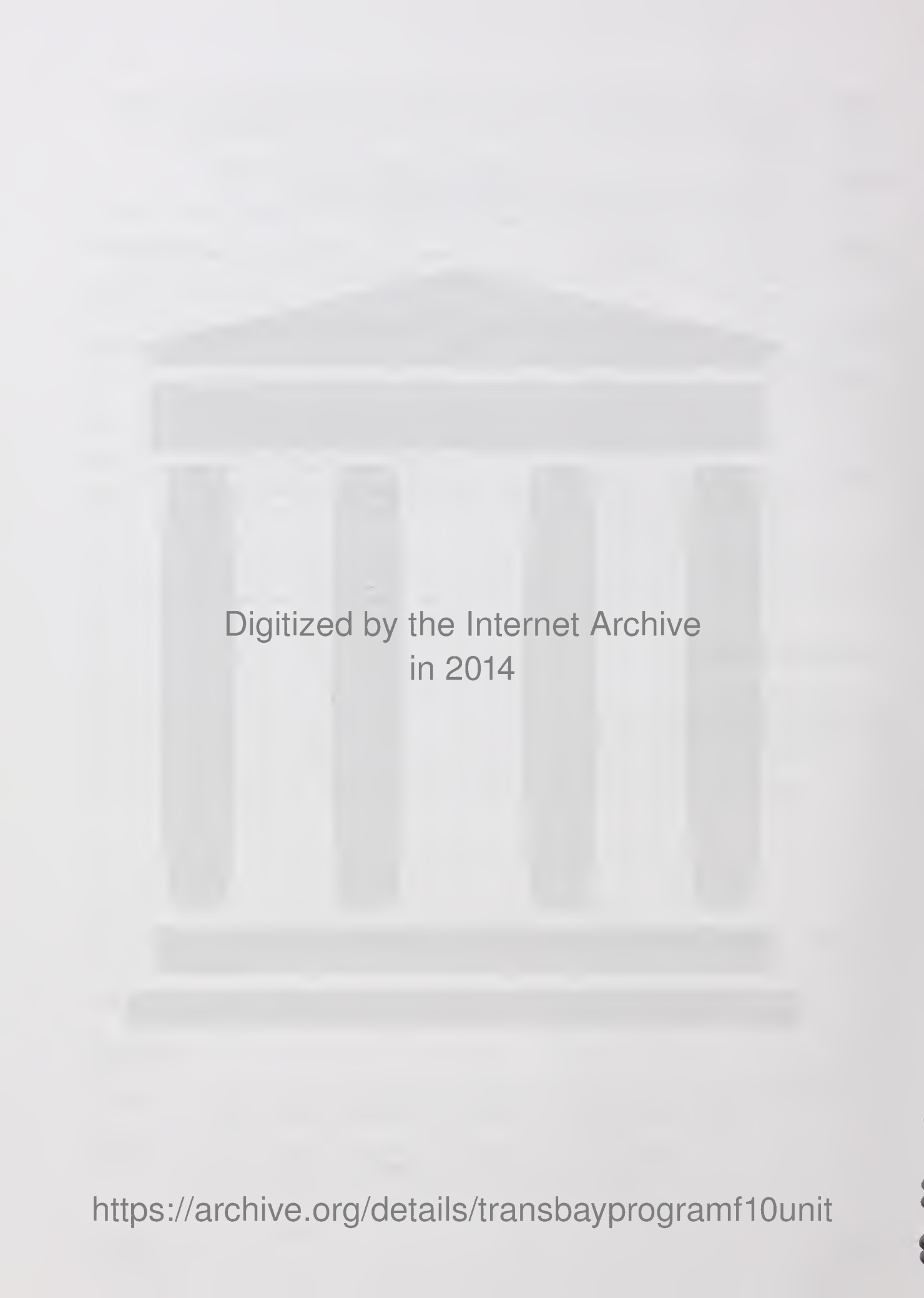
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# Transbay Program 2004 EIS Reevaluation

Updating the Transbay Program 2004 EIS for Adoption by the Federal Railroad Administration

## I. Introduction and Summary of Conclusions

The Federal Railroad Administration ("FRA") is adopting the portion of the March 2004 Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project ("Transbay Program") Final Environmental Impact Statement/Environmental Impact Report ("2004 EIS") that covers Phase 1 of the Transbay Program to satisfy FRA's obligations under the National Environmental Policy Act ("NEPA"). FRA is adopting the Phase 1 portions of the 2004 EIS to support a decision to provide grant funding for the Transbay Transit Center train box. FRA has prepared this Reevaluation of the Phase 1 portions of the 2004 EIS to consider recent modifications to the train box design and to update environmental information contained in the 2004 EIS pursuant to FRA's Procedures for Considering Environmental Impacts (64 FR 28545, May 26, 1999).

The American Recovery and Reinvestment Act ("Recovery Act") provided $8 billion as initial funding for the High-Speed Intercity Passenger Rail ("HSIPR") grant program. The Secretary of Transportation selected the California High-Speed Rail Authority ("CHSRA") to receive up to $2.25 billion from the Recovery Act to fund the development of high-speed intercity passenger rail service in California. As the Transit Center has been demonstrated to be the only feasible and practicable site in San Francisco for the northern terminus of the California high-speed rail system, it is the intention of the FRA to provide up to $400 million of the CHSRA Recovery Act funding to the Transbay Joint Powers Authority ("TJPA") in order to begin construction of the train box designed to accommodate the future high-speed rail service at the Transit Center.

FRA is adopting the 2004 EIS pursuant to the regulations promulgated by the Council on Environmental Quality ("CEQ").[1] CEQ regulations permit Federal agencies to adopt a Final EIS, or portion thereof, issued by another Federal agency if the EIS or portion thereof "meets the standards for an adequate statement" and the actions covered by the original environmental impact statement and the proposed action are "substantially the same." FRA has determined that the 2004 EIS meets the standards for adequacy and the action covered is substantially the same as the FRA's proposed action.

Part II of this Reevaluation updates the description of the train box, including the method and staging of construction; summarizes five addenda to the 2004 EIS that evaluated modifications to and refinements of the Transbay Program; and updates California high-speed train ("HST") ridership projections based on the most recent projections from the CHSRA in its report to the Legislature in December 2009.

Part III reevaluates certain elements of the environmental analyses in the 2004 EIS that are pertinent to providing HST service at the Transit Center; specifically, air quality, including greenhouse gas; transportation, including vehicles, transit, parking, and pedestrians; noise and vibration; construction impacts, including solid waste generated by construction; and cumulative impacts of HST service.

Part IV updates the financial analysis in the 2004 EIS, Part V discusses FRA's intent to become a signatory to the Section 106 Memorandum of Agreement ("MOA") for the Transbay Program, and Part VI summarizes the conclusions of this Reevaluation.

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[1] 40 C.F.R. 1506.3

In summary, this Reevaluation does not identify any changes to Phase 1 of the Transbay Program that would result in significant environmental impacts that were not previously evaluated in the 2004 EIS, nor does it identify new information or circumstances relevant to environmental concerns and bearing on the proposed action or its impacts that would result in significant environmental impacts not previously evaluated in the 2004 EIS. Based on the Reevaluation, FRA has determined that the 2004 EIS is still adequate, accurate, and valid to support the proposed action.

## II. UPDATES TO DESCRIPTION OF THE PHASE 1 TRAIN BOX

Phase 1 of the Transbay Program consists of construction of the new Transit Center and the below-grade train box. The proposed FRA action is the funding of construction of the Transit Center train box through FRA's HSIPR Program. The Transit Center will replace the existing 1939 Transbay Terminal, located at First and Mission streets in downtown San Francisco, with a modern multi-modal transit hub serving as the San Francisco terminus for HST service between Los Angeles and San Francisco; Caltrain commuter train service from the Peninsula to San Francisco; regional public and private bus networks[2]; and connections between HST and San Francisco Municipal Railway light rail ("San Francisco Muni"), Bay Area Rapid Transit ("BART"), and bus service including Amtrak Thruway Bus Services.

The design of Phase 1 is well advanced, and the land acquisition is nearly complete. The Temporary Terminal has been constructed on an adjacent site and is ready for occupancy. The bus services are ready to be relocated to the new Temporary Terminal, following adequate prior notice, at which time the existing terminal will be demolished and construction of the Transit Center, including the train box, will commence.

### A. Description of Train Box

The Phase 1 train box[3] will be constructed of reinforced concrete and consists of two levels. The lower level will have six tracks and three platforms serving Caltrain and HST. The upper level, referred to as the lower concourse, will serve as a rail passenger ticketing and waiting area; both levels will be connected to the building by stairs, elevators, and escalators. The 2004 EIS also describes train tracks extending to the east side of Beale Street into a tail track structure; the tail track structure is not part of Phase 1. Where the alignment narrows at the west end of the train box to connect to the rail tunnel, the train box will accommodate the utility, signal, and control systems required for HST and Caltrain. This narrowing of the alignment at the west end of the train box is designated the throat structure; the throat structure is not part of Phase 1.

Phase 2 consists of construction of the Caltrain Downtown Extension or "DTX" (the rail tunnel), the throat structure, and the tail tracks. Phase 2 will include modifications to the track curvature in the throat structure and an increase in the tangent length of the HST rail platforms, in accordance with CHSRA design criteria[4] and in order to provide sufficient capacity for HST service. Construction of the Phase 2 modifications are not yet environmentally cleared, will occur in the future, and are not part of the current FRA action.

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[2] The bus networks that will be served are Alameda-Contra Costa Transit ("AC Transit"), San Francisco Municipal Railway, SamTrans, Golden Gate Transit, Greyhound, WestCAT Lynx, and Amtrak Thruway.

[3] The train box is also referred to in the HSIPR application as the "rail box."

[4] On April 8, 2010, the CHSRA board of directors approved granting a variance from certain HST design criteria for the Transit Center, and concluded that the variance "would be acceptable to receive the high-speed trains at the current level of service for the Transbay Transit Center." (CHSRA Staff Report re Transbay Transit Center Design/Trainbox (March 31, 2010), p. 1, Exhibit 9b hereto.)

**Change in Train Box Construction Phasing.** The 2004 EIS anticipated completion of the Transit Center, including the train extension from the Fourth and Townsend Street Station, in a single construction phase. Then, in June 2006, the TJPA analyzed and approved a two-phase construction process for the Transbay Program to leverage the then-committed funding. Construction of the above-grade portion of the Transit Center and limited below-grade structural support work would be the first phase, and construction of the train tunnel to the Transit Center and completion of the train box below grade would be the second phase. The two-phase process would have lengthened the construction schedule; therefore, the TJPA prepared an addendum to the 2004 EIS (see discussion of the first addendum in subsections II.B [First Addendum] and II.C [Construction Schedule], below). The first addendum concluded that construction mitigation measures identified in the 2004 EIS, and adopted and incorporated into the Program, would be applied to the lengthened construction schedule, and that these mitigation measures would remain effective in mitigating construction impacts, including hauling- and construction-related access and circulation impacts, to a less-than-significant level.

The announcement in January 2010 of HSIPR Program funding of up to $400 million for construction of the Transit Center train box made possible the construction of the below-grade train box as part of Phase 1. The current Program phasing now consists of constructing the Transit Center and train box as Phase 1 and the DTX alignment as Phase 2. The Transit Center will be constructed using a bottom-up approach, which consists of a single construction stage, and is consistent with the 2004 EIS.

**Changes to the Train Box.** As shown in Figure 1 and Appendix A, the proposed train box is substantially similar to the description in Section 2.2.2.1 and Figure 2.2-17 of the 2004 EIS. The 2004 EIS described the dimensions of the Transit Center as one block by three blocks, or 165 feet by 1,300 feet, at street level. The train box will be 1,500 feet long by approximately 190 feet wide and will extend 60 feet below ground. The train box remains two levels below grade as described in Section 2.2.2.1 and is within the length shown on Figure 2.2-17. The train box is slightly wider than the overall Transit Center width described in the 2004 EIS; however, the additional width (approximately 18 to 25 feet) is within the engineering tolerances of the original design, and does not require any additional property acquisition or otherwise result in any new environmental impacts, because construction of the additional width will occur underground, will not affect any new structures, is relatively small, and is included in the construction activities already analyzed in the 2004 EIS and mitigated to a less-than-significant level by mitigation measures adopted and incorporated into the Program (2004 EIS, pp. 5-184 to 5-225 [Construction Impacts]; TJPA, *Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project FEIS/FEIR Mitigation Monitoring and Reporting Program* [MMRP], pp. 18-22.). As determined in the Fifth Addendum, "[t]he train box remains in the location identified in previous environmental documents." (TJPA, *Fifth Addendum to the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project Final Environmental Impact Statement/Environmental Impact Report* (March 30, 2009), p. 2.)

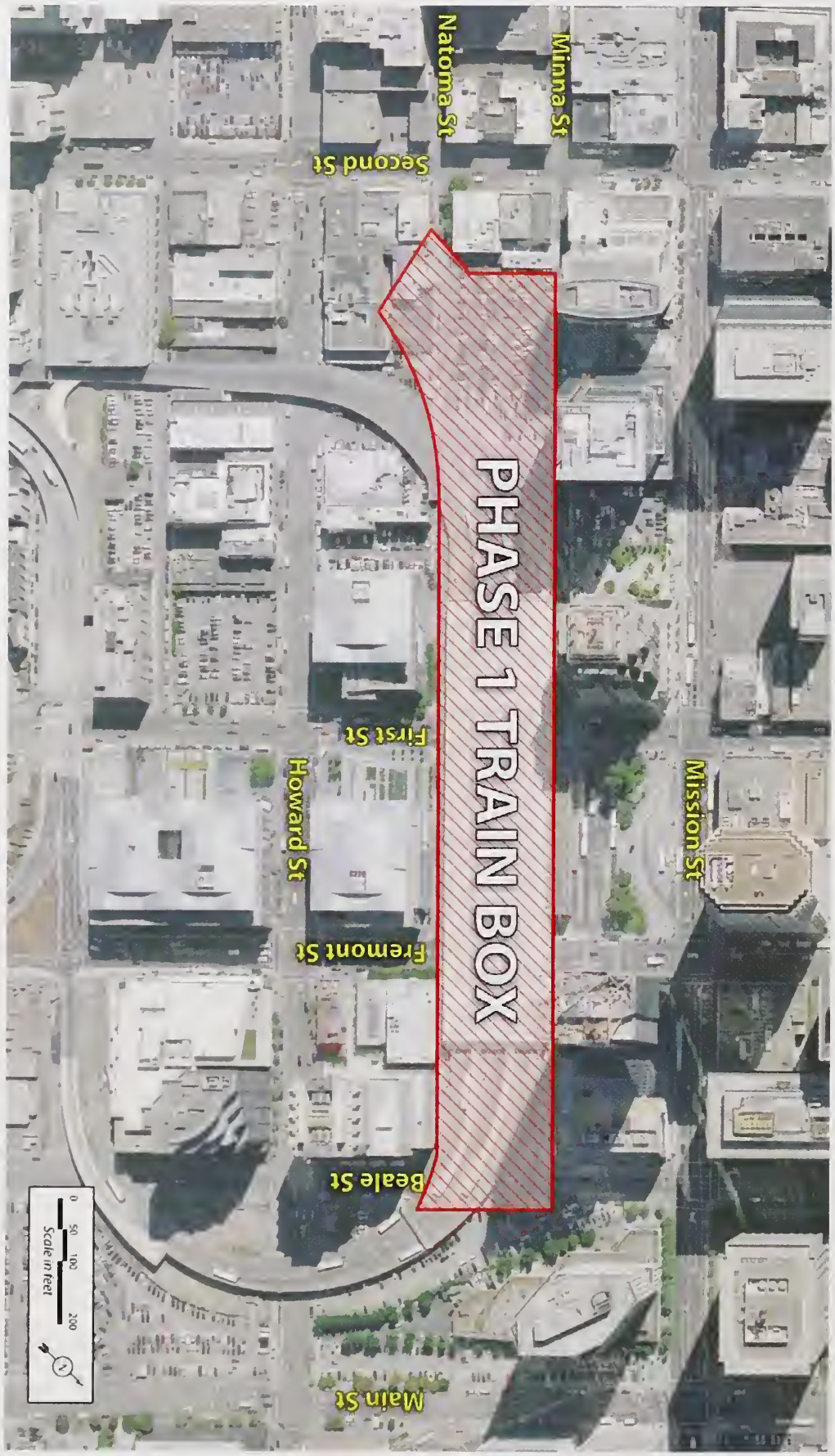


Figure 1, Phase 1 Train Box

## B. Addenda to the 2004 EIS

The Federal Transit Administration ("FTA") issued a Record of Decision ("ROD") in February 2005, which determined that the 2004 EIS satisfied the requirements of NEPA. Since that time, the TJPA Board of Directors has adopted five addenda to the 2004 EIS, each prior to approving modifications and refinements to the Transbay Program. The modifications and refinements to the Transbay Program evaluated in the five addenda, and summarized below and attached as Exhibits 1 through 5, have not substantially changed the scope of the train box.

**First Addendum**. The first addendum to the 2004 EIS evaluated modifications and refinements to the Transit Center design and construction staging, and revisions to the Temporary Terminal site plan (Exhibit 1). The first addendum was adopted by the TJPA Board of Directors on June 2, 2006. The changes considered in the first addendum included the following refinements to the Transit Center component of the locally preferred alternative:

- reduction in the building height and size;
- consolidation of the bus operations on the AC Transit level;
- relocation of Greyhound operations to the train mezzanine (lower concourse);
- elimination of one level of bus ramp;
- improvements in public access and pedestrian circulation at the ground level;
- a two-stage construction process;[5]
- use of a temporary Greyhound boarding area prior to construction of the permanent boarding facility in the second stage; and
- use of a reduced number of piles (caissons) for construction of the Transit Center building.

**Second Addendum**. The second addendum evaluated modifications and refinements to the locally preferred alternative for the "DTX" portion of the Transbay Program, including design provisions to allow future construction of a Townsend/Embarcadero/Main Loop and delay in construction of tail tracks on Main Street pending the outcome of future rail planning studies to accommodate HST (Exhibit 2). The second addendum was adopted by the TJPA Board on April 19, 2007. The modifications considered in the second addendum included the following changes to the DTX component of the approved locally preferred alternative, all of which contribute to a reduction in the size of various elements of the DTX component or rearrangement of uses within the Program area previously analyzed in the 2004 EIS:

- two-track lead on the surface and below ground leading to the DTX tunnel system to just before the Fourth and Townsend Street underground station;
- three tracks beginning at the Fourth and Townsend Street underground station and continuing to the throat section approaching the Transit Center where the three-track system splays to six tracks to accommodate the six platform berthing locations within the station;
- at-grade rail car storage within the existing Caltrain rail storage yard rather than underground storage, which would reduce the amount of underground construction associated with the project and would not significantly change the existing use of the rail storage area; design provisions to allow for a future connection to the cut-and-cover tunnel on Townsend Street that will facilitate construction of future system capacity for both Caltrain and HST, and will be capable of

[5] As described in Section II.C, this revised staging plan was subsequently rescinded, and the Transit Center construction phasing reverted back to the phasing analyzed in the 2004 EIS.

accommodating the construction of a future Townsend Street/Embarcadero/Main Street Loop with minimal disruption to ongoing rail service; and

- delay in construction of the tail tracks, pending the outcome of future planning studies related to accommodating HST and optimizing concurrent Caltrain and HST operations, which would reduce the amount of underground construction within the project footprint analyzed in the 2004 EIS at this time.

**Third Addendum**. The third addendum evaluated adding 546 Howard Street, which was identified in the 2004 EIS for partial acquisition, to the list of properties identified for full acquisition (Exhibit 3). The third addendum was adopted by the TJPA Board on January 17, 2008. The 546 Howard Street property is an undeveloped lot used for surface parking. The entire property was determined to be needed for construction staging for the Transit Center project. The only increased physical effect of acquiring the entire property, rather than part of the property, is that more surface parking would be removed. The San Francisco Planning Code Section 161(c) does not require the provision of off-street parking for any use in the downtown in light of the compact and congested nature of the area.

**Fourth Addendum**. The fourth addendum evaluated the configuration, boarding platforms and waiting areas, bus staging areas, and street design associated with the Temporary Terminal (Exhibit 4). The fourth addendum was adopted by the TJPA Board on October 17, 2008. The modifications and refinements considered in the fourth addendum included the following changes to the Temporary Terminal component of the approved locally preferred alternative:

- consolidation of the Temporary Terminal facilities on a single block, bounded by Folsom, Main, Howard, and Beale streets;
- incorporation of boarding facilities and passenger waiting areas for Greyhound and AC Transit bus services into the interior of the block;
- reconfiguration of the boarding and staging areas for the other bus operators around the perimeter of the block and along adjacent blocks; and
- modifications to the bus lane configuration on the surrounding streets.

**Fifth Addendum**. The fifth addendum evaluated the building design for the Transit Center, specifically, the exterior façade of the upper levels, a pedestrian bridge over Beale Street, and associated public right-of-way vacations (Exhibit 5). The fifth addendum was adopted by the TJPA Board on April 9, 2009, and authorized the Executive Director of the Transbay Joint Powers Authority ("TJPA") to submit a street vacation application to the City and County of San Francisco. Based on results of the design competition and refinements to design of the Transit Center, certain modifications and refinements to the Transit Center design have occurred, specifically: (1) the addition of above-ground outer wall basket structures, and (2) the possible addition of a pedestrian bridge over Beale Street ("Design Modifications"). The Transit Center, including its Design Modifications, will need to occupy portions of the public streets and sidewalks that are owned by the City and County of San Francisco as a public right-of-way. The Transit Center will need to occupy areas above and below public streets and sidewalks, specifically:

- air space for the Transit Center outer wall basket structures over Minna, Natoma, and Beale streets;
- air space for the proposed pedestrian bridge over Beale Street;
- air space for the Transit Center bus deck bridges over First and Fremont streets;
- below ground for the train box under Minna, Natoma, First, Fremont, and Beale streets; and

- air space for the bus ramps connecting the Transit Center to Interstate 80 where the bus ramps cross over Natoma, Howard, Tehama, Clementina, Folsom, Harrison, and First streets.

## C. Construction Schedule and Methods

**Construction Schedule**. As discussed in Section II.B, in June 2006, the TJPA approved a two-phase construction process for the Transbay Program (TJPA, First Addendum to 2004 EIS). The 2004 EIS had previously anticipated completion of the Transit Center, including the train extension from the Fourth and Townsend Street Station, in one construction phase. The two-phase process proposed construction of the above-grade portion of the Transit Center and limited below-grade structural support work as the first phase, and construction of the train tunnel to the Transit Center and completion of the train box below grade as the second phase. The two-phase process would have lengthened the construction schedule. Accordingly, the first addendum analyzed whether this lengthened construction schedule would result in any new significant impacts. The first addendum found that construction impacts, including hauling- and construction-related access and circulation impacts, would be mitigated to a less-than-significant level. (TJPA, First Addendum to 2004 EIS, pp. 16-17.)

This conclusion remains valid for the current construction schedule. Demolition of the existing terminal and construction of the Transit Center, including the train box, is now expected to last roughly 7 years, or 3½ years longer than estimated in the 2004 EIS. Daily construction-related traffic and activities would not increase from what was assumed in the 2004 EIS, however. Construction mitigation measures identified in the 2004 EIS and adopted and incorporated into the Program would be applied to the lengthened construction schedule. (2004 EIS, pp. 5-158 to 5-222; MMRP, pp.18-22.) These include pre-construction measures to protect building integrity and local businesses; general construction measures to maintain adequate vehicle and pedestrian circulation; "basic control measures" and "enhanced control measures" recommended by the Bay Area Air Quality Management District ("BAAQMD") to reduce construction air emissions; and measures to reduce visual and aesthetic impacts from construction. As determined in the first addendum, these mitigation measures would remain effective in mitigating construction impacts to a less-than-significant level despite the longer construction period. Accordingly, the lengthened construction schedule would not produce any new significant environmental impacts, and was environmentally cleared in the first addendum.

Following adoption of the first addendum to the 2004 EIS, it was determined that construction of the below-grade train box would be included as part of the first phase, consistent with the 2004 EIS. FTA issued a memorandum on August 13, 2009, included as Exhibit 6a, which concluded that this change would not result in any additional environmental impacts not analyzed in the 2004 EIS, and that no additional environmental review would be required. (FTA, *Environmental clearance for advance construction of train box portion of Transbay Transit Center,* August 13, 2009.)[6] The adopted construction phasing now consists of constructing the Transit Center as Phase 1 and the DTX alignment as Phase 2. The Transit Center will be constructed using a bottom-up approach, which consists of a single construction stage, and is consistent with the 2004 EIS.

While consistent with the 2004 EIS, the start of construction for the Transit Center has been delayed. The updated construction schedule, shown in Table 1, commences 3 years later than the schedule shown in the 2004 EIS. The revised schedule shows the anticipated start of demolition in the second half of 2010.

[6] The August 2009 memorandum was issued by the FTA in conjunction with the Department of Transportation's award of a TIFIA loan to the TJPA.

**Construction Methods**. The proposed construction equipment and methods for demolition of the existing terminal and construction of the Transit Center remain consistent with the equipment and methods identified in Section 5.20 of the 2004 EIS.

## D. HST Ridership

The 2004 EIS assumed that the Transit Center would need to accommodate 43,000 HST boardings and alightings (i.e., passengers) per day in 2020 in addition to 29,300 Caltrain boardings and alightings. (2004 EIS, pp. 3-31, 3-33.) The HST passenger figures were not used for all 2004 EIS analyses, however. Since the 2004 EIS was completed, revised HST ridership projections past 2020 (for 2035) have become available and are used in this Reevaluation to assess the effects from all projected HST ridership, not just the increment above the ridership assumed in the 2004 EIS. The CHSRA most recently refined its ridership projections in its Report to the Legislature December 2009 ("December 2009 Business Plan"), attached hereto as Exhibit 9a. The December 2009 Business Plan, Table D, projects 24,100 daily HST boardings at the Transit Center in 2035, which is equivalent to approximately 48,200 boardings and alightings (passengers). Of these, approximately 80% are expected to be inter-regional travelers, and the remaining 20% are expected to be local commuters (December 2009 Business Plan, p. 72). Table F of the December 2009 Business Plan indicates that 54% of inter-regional travelers and 66% of commuters will travel during the 6-hour daily peak period. As indicated in Figure 6 of the December 2009 Business Plan, the anticipated passenger boardings at the Transit Center during the heaviest peak hour will be approximately 3,550 people. Hourly boardings at the Transit Center during off-peak periods are shown in Figure 7 to be approximately 900 passengers. This is equivalent to approximately 8 trains per hour into and from the Transit Center during the morning and evening peak periods of 3 hours each, and approximately 6 trains per hour into and from the Transit Center during the remaining 10 off-peak hours of operation.

Section III of this Reevaluation updates the 2004 EIS by analyzing how these currently forecast HST ridership projections might impact air quality, transportation, and noise and vibration and affect construction impacts and cumulative impacts.

**Table 1. Estimated Construction Phasing for Transbay Transit Center and Caltrain Downtown Extension [a]**

| Calendar Years | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Activity** | | | | | | | | | | | | | | | | | |
| Operations Analysis, Preliminary Engineering, Geotechnical Engineering | | | | | | | | | | | | | | | | | |
| Program Review/Value Engineering | | | | | | | | | | | | | | | | | |
| Final Design & Permitting - Transbay Terminal | | | | | | | | | | | | | | | | | |
| Final Design & Permitting - Caltrain Extension | | | | | | | | | | | | | | | | | |
| Acquire Property, Design, Construct Temporary Terminals (Transit and Greyhound) | | | | | | | | | | | | | | | | | |
| Acquire Property & Demolish Buildings along Caltrain Extension | | | | | | | | | | | | | | | | | |
| Design and Relocate Utility Lines along Caltrain Extension | | | | | | | | | | | | | | | | | |
| Construct Surface Rail & Improvements at Caltrain Fourth and Townsend Yard | | | | | | | | | | | | | | | | | |
| Construct Cut-and-Cover and Retained-Cut - Caltrain Extension | | | | | | | | | | | | | | | | | |
| Reconstruct Streets | | | | | | | | | | | | | | | | | |
| Construct Caltrain Tunnel | | | | | | | | | | | | | | | | | |
| Construct Caltrain Track & Systems Facilities | | | | | | | | | | | | | | | | | |
| Demolish Existing Transbay Terminal & Ramps, Construct New Terminal & Ramps | | | | | | | | | | | | | | | | | |
| Construct Permanent Off Site Bus Storage Facility | | | | | | | | | | | | | | | | | |

[a] Assumes West Ramp, Second-to-Main, Tunnel Option

# III. ENVIRONMENTAL REEVALUATION OF PERTINENT 2004 EIS ANALYSES

This section reevaluates certain elements of the environmental review in the 2004 EIS, and provides an update to those sections for which new information is available that is pertinent to the proposed action.

## A. Air Quality

Sections 5.7 (operational impacts) and 5.21.9 (construction impacts) of the 2004 EIS analyzed the air quality impacts of the Transbay Program, including the Transit Center. The 2004 EIS concluded that the operational impacts would not be significant, because vehicle miles traveled ("VMT") in the region would be reduced and there would be no carbon monoxide exceedences at local intersections in the vicinity of the Transit Center. While air quality impacts of construction of the Transit Center could result in short term emissions of nitrogen oxides, carbon monoxide, and sulfur oxides from diesel-powered construction equipment; carbon monoxide emissions from worker vehicles; dust or respirable particulate matter emissions from vehicles traveling on unpaved surfaces and/or grading and other earthmoving activities; and reactive organic gas emissions from asphalt placement and architectural coatings; there are no quantitative emissions thresholds for construction activities, which by their nature are temporary and occur over a large area, potentially affecting different receptors at different times. The 2004 EIS used the BAAQMD's approach to the analysis of construction impacts, which involves implementation of effective and comprehensive control measures rather than detailed quantification of emissions. These measures are identified on page 5-205 of the 2004 EIS and are incorporated into Mitigation Measures AC 01 through AC 15 (TJPA, MMRP, pp. 20-21; FTA and SHPO, MOA, p. 15). The MMRP is included as Exhibit 7, and the MOA is included as Exhibit 8.

### 1. Air Quality Conformity

The 2004 EIS determined that there would be no air quality exceedences, because the Transbay Program would be consistent with the conformity requirements established by the United States Environmental Protection Agency ("USEPA"), and the 2004 EIS determined that the Transbay Program met conformity requirements (2004 EIS, pp. 5-61 to 5-64). In FTA's 2005 ROD, the FTA concurred with the 2004 EIS conformity determination (FTA, ROD, pp. 14-15). Thus, no exceedences of state or federal ambient air quality standards were projected in the future analysis year of 2020, and no mitigation is proposed for long-term air quality effects resulting from project operation.

This section updates federal and state air quality standards; updates air quality conditions in the Bay Area and study area; and analyzes air quality impacts associated with providing HST service to the Transit Center. This section also reviews and updates the air quality Transportation Conformity analysis conducted in the 2004 EIS and incorporates by reference the General Conformity analysis contained in the 2008 Bay Area to Central Valley High Speed Train (HST) Final Program EIR/EIS (CHSRA and U.S. Department of Transportation FRA, 2008), hereinafter referred to as the "2008 Bay Area to Central Valley EIR/EIS." This section confirms that both the 2004 Transportation Conformity analysis and the 2008 Bay Area to Central Valley EIR/EIS General Conformity analysis are still valid.

## 2. Affected Environment Updates

This subsection updates the regional, state, and federal air pollutant regulatory setting and attainment status described in Section 4.6 of the 2004 EIS. This subsection also updates the existing air quality conditions based on the past five years of data from air quality monitoring at the Arkansas Street monitoring station. These updates do not have any effect on the impact analysis or change the way the impact analysis was performed. They are presented to update the existing conditions of the Transbay Program area.

### *Federal and State Air Quality Standards*

Since the 2004 EIS was completed, several national and California ambient air quality standards have changed. The most recent federal and state standards are shown in Table 2. Table 2 presents a side-by-side comparison of the National Ambient Air Quality Standards ("NAAQS") and California Ambient Air Quality Standards ("CAAQS") values from the 2004 EIS with the updated values.

The changes in the ambient air quality standards presented in Table 2 are summarized as follows:

- On January 6, 2010, the USEPA proposed to strengthen the national 8-hour ozone standard from 0.08 parts per million ("ppm") to a level within the range of 0.06 to 0.07 ppm. USEPA will issue final standards by August 31, 2010, and will make final area designations by July 2011.
- The national 1-hour ozone standard was revoked by USEPA on June 15, 2005.
- In June 2002, the California Air Resources Board ("CARB") established new annual ambient standards for fine particulate matter ($PM_{2.5}$) and respirable particulate matter ($PM_{10}$).
- On March 24, 2010, the USEPA issued its final rule to ensure that transportation conformity requirements are consistent with $PM_{2.5}$ and $PM_{10}$ standards and that state and local transportation projects do not create localized hot spots of particulate matter. The rule will take effect on April 23, 2010.
- The 8-hour California ozone standard was approved by CARB on April 28, 2005, and became effective on May 17, 2006.
- USEPA lowered the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ in 2006. USEPA issued attainment status designations for the 35 $\mu g/m^3$ standard on November 13, 2009, and has designated the Bay Area as non-attainment for the 35 $\mu g/m^3$ $PM_{2.5}$ standard.

### *Attainment Status and Existing Monitored Air Quality*

The updated Bay Area attainment status with the NAAQS and CAAQS for all criteria pollutants is presented in Table 3. Since the 2004 EIS was completed, there have been several attainment designation changes in the Bay Area. According to the BAAQMD, the Bay Area air basin is currently in attainment with national standards for carbon monoxide (CO), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), and annual $PM_{2.5}$. It is currently designated non-attainment for ozone ($O_3$) and 24-hour $PM_{2.5}$, and attainment/unclassified for 24-hour $PM_{10}$. With respect to California standards, the Bay Area air basin is currently designated as attainment for carbon monoxide, nitrogen dioxide, and sulfur dioxide. It is currently designated non-attainment for state ozone, $PM_{2.5}$, and $PM_{10}$ standards.

**Table 2. National and California Ambient Air Quality Standards**

| National and California Ambient Air Quality Standards (2004 EIS) | | | | Current National and California Ambient Air Quality Standards ( March 2010) | | | |
|---|---|---|---|---|---|---|---|
| **Pollutant** | **Averaging Time** | **National Standard** | **California Standard** | **Pollutant** | **Averaging Time** | **National Standard** | **California Standard** |
| Ozone | 1 hour | 0.12 ppm* | 0.09 ppm | Ozone | 1 hour | --- | 0.09 ppm |
| | 8 hour | 0.08 ppm | N/A | | 8 hour | 0.06-0.07 ppm | 0.07 ppm |
| Carbon Monoxide | 1 hour | 35 ppm | 20 ppm | Carbon Monoxide | 1 hour | 35 ppm | 20 ppm |
| | 8 hour | 9 ppm | 9.0 ppm | | 8 hour | 9 ppm | 9 ppm |
| Nitrogen Oxides | 1 hour | --- | 0.25 ppm | Nitrogen Oxides | 1 hour | 0.1 ppm | 0.18 ppm |
| | Annual | 0.053 ppm | --- | | Annual | 0.053 ppm | 0.03 ppm |
| Sulfur Dioxide | 1 hour | --- | 0.25 ppm | Sulfur Dioxide | 1 hour | --- | 0.25 ppm |
| | 24 hour | 365 µg /m3 | 0.04 ppm | | 24 hour | 365 µg /m3 | 0.04 ppm |
| | Annual | 80 µg /m3 | --- | | Annual | 80 µg /m3 | --- |
| Suspended Particulates (PM10) | 24 hour | 150 µg/m3 | 50 µg/m3 | Suspended Particulates (PM10) | 24 hour | 150 µg/m3 | 50 µg/m3 |
| | Annual | 50 µg/m3 | 30 µg/m3 | | Annual | --- | 20 µg/m3 |
| Particulate Matter– Fine (PM2.5) | 24 hour | 65 µg/m3 | --- | Particulate Matter – Fine (PM2.5) | 24 hour | 35 µg/m3 | --- |
| | Annual | 15 µg/m3 | --- | | Annual | 15 µg/m3 | 12 µg/m3 |

* ppm = parts per million; µg/m3 = micrograms per cubic meter

Source: California Air Resources Board (CARB), 1999.

Source: CARB: http://www.arb.ca.gov/research/aaqs/aaqs.htm

**Table 3. Current Federal and State Attainment Status for the Bay Area**

| Pollutant | Federal Status | State Status | Change since 2004 EIS |
|---|---|---|---|
| $O_3$ | Non-attainment, marginal for 8-hour average (1) | Non-Attainment for 1 hour and 8 hour average | Federal – from no standard to non-attainment for 8-hour standard; no status for revoked 1-hour standard<br>State – from no standard to non-attainment for 8-hour standard; no change for 1-hour standard |
| $PM_{10}$ | Attainment/Unclassified | Non-attainment, 24 hour and annual standard | Federal and State – No Change |
| $PM_{2.5}$ | Attainment, annual standard; non-attainment, 24-hour standard | Non-attainment, annual standard | Federal - from unclassified to non-attainment, 24-hour standard<br>State – from no designation to non-attainment, annual standard |
| CO | Attainment | Attainment | No Change |
| $NO_2$ | Attainment | Attainment | No Change |
| $SO_2$ | Attainment | Attainment | No Change |

Notes: (1) In June 2004, the Bay Area was designated as a marginal non-attainment area of the national 8-hour ozone standard. On January 6, 2010, USEPA proposed to strengthen the national 8-hour ozone standard from 0.08 parts per million (ppm) to a level within the range of 0.06-0.070 ppm. USEPA will issue final standards by August 31, 2010, and will make final area designations by July 2011. Source: BAAQMD, http://hank.baaqmd.gov/pln/air_quality/ambient_air_quality.htm; USEPA, http://www.epa.gov/air/ozonepollution/actions.html

Existing air quality conditions in the study area are reflected by measurements taken at the nearest BAAQMD monitoring station, which is the Arkansas Street monitoring station in San Francisco. Table 4 presents the updated ambient air measurement data for the last five years of available data from the Arkansas Street monitoring station. The table indicates federal and state standards for these pollutants, and where these pollutant standards have been exceeded. Table 4 also presents a side-by-side comparison of the recorded monitoring values from the 2004 EIS, which presented data for the years 1996 to 2000, and the updated values for the years 2004 to 2008. The carbon monoxide, nitrogen dioxide, and sulfur dioxide data decreased slightly in the 2004 to 2008 period; the ozone data increased slightly for some years and decreased slightly for others in the 2004 to 2008 period. The $PM_{10}$ data decreased for the 2004 to 2008 period, except for the year 2006.

The analysis in the 2004 EIS included a quantitative particulate matter analysis with dispersion modeling used to evaluate nearby concentrations of all criteria pollutants including $PM_{10}$. Though $PM_{2.5}$ was not modeled, $PM_{10}$ was, and it is considered a suitable and conservative surrogate for $PM_{2.5}$. That is because $PM_{10}$ includes all particulate matter smaller than 10 microns in diameter and, therefore, also includes particles that are smaller than 2.5 microns in diameter (i.e., $PM_{2.5}$). The modeling analysis found $PM_{10}$ emissions to be below the current federal 24-hour $PM_{2.5}$ standard, thereby adequately demonstrating that the Transbay Program would not lead to a $PM_{2.5}$ violation. Therefore, the Program is considered to be consistent with the new 2010 USEPA final rule identified in Section III.A.2, Federal and State Air Quality Standards.

Changes in the federal and state attainment status for the Bay Area do not change the Program's impacts. That is because, as previously discussed, the Transbay Program, including the Transit Center, and the proposed HST system would result in beneficial impacts related to air quality, because these projects would result in the beneficial reduction in VMT and reduction in the number of airplane trips.

*Greenhouse Gases (GHGs)*

**Background Regarding GHGs and Environmental Effects**. GHGs are gases that trap heat in the atmosphere because they capture heat radiated from the sun as it is reflected back into the atmosphere, much like a greenhouse does. The accumulation of GHGs has been implicated as a driving force for global climate change. Definitions of climate change vary between and across regulatory authorities and the scientific community, but in general they can be described as the changing of the earth's climate caused by natural fluctuations and anthropogenic activities that alter the composition of the global atmosphere.

Individual projects contribute to the cumulative effects of climate change by emitting GHGs during demolition, construction, and operational phases. The principal GHGs are carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), ozone, and water vapor. Carbon dioxide is the "reference gas" for climate change, meaning that emissions of GHGs are typically reported in "carbon dioxide-equivalent" measures ($CO_2e$). Thus, the "carbon dioxide-equivalent" measure of $CO_2$ is 1, and the terms "$CO_2$" and "$CO_2e$" are interchangeable for this analysis. Emissions of carbon dioxide are largely by-products of fossil fuel combustion, whereas methane results from off-gassing associated with agricultural practices and landfills. Other GHGs, with much greater heat-absorption potential than carbon dioxide, including hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, are generated in certain industrial processes. The predominant GHG associated with the proposed Transit Center is $CO_2$.

**Addressing GHGs in NEPA Documents**. At the time the 2004 EIS was completed, the study and analysis of GHGs was not generally included in NEPA documents. The $CO_2e$ emissions associated with the California HST system have been quantified, and are presented in Section III.A.3. Providing HST service, even taking account of the $CO_2e$ emissions resulting from construction of the HST system, would decrease GHGs compared to the No Action scenario as a result of a decrease in VMT.

**Table 4. Summary of Pollutant Monitoring Data at San Francisco – Arkansas Street Monitoring Station**

| Data Taken from 2004 EIS | | | | | | Updated Data Based on most Recent Five Years of Monitoring | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pollutant** | **State Standard** | **Federal Standard** | **Year** | **Maximum Level** | **Violation Days** | **Pollutant** | **State Standard** | **Federal Standard** | **Year** | **Maximum Level** | **Violation Days** |
| Ozone 1 hour | 0.09 ppm | 0.12 ppm | 1996 | 0.07 | 0/0 | Ozone 1 hour | 0.09 ppm | --- | 2004 | 0.093 | 0/0 |
| | | | 1997 | 0.07 | 0/0 | | | | 2005 | 0.058 | 0/0 |
| | | | 1998 | 0.05 | 0/0 | | | | 2006 | 0.053 | 0/0 |
| | | | 1999 | 0.08 | 0/0 | | | | 2007 | 0.06 | 0/0 |
| | | | 2000 | 0.06 | 0/0 | | | | 2008 | 0.082 | 0/0 |
| Particulates ($PM_{10}$) 24 hours | 50 µg/m3 | 150 µg/m3 | 1996 | 70.9 | 2/0 | Particulates ($PM_{10}$) 24 hours | 50 µg/m3 | 150 µg/m3 | 2004 | 51.4 | 1/0 |
| | | | 1997 | 81 | 3/0 | | | | 2005 | 46.4 | 0/0 |
| | | | 1998 | 52.4 | 1/0 | | | | 2006 | 61.4 | 3/0 |
| | | | 1999 | 77.9 | 6/0 | | | | 2007 | 69.8 | 2/0 |
| | | | 2000 | 63.2 | 2/0 | | | | 2008 | 41.3 | 0/0 |
| Carbon Monoxide 8 hour | 9.1 ppm | 9.5 ppm | 1996 | 3.8 | 0/0 | Carbon Monoxide 8 hour | 9.0 ppm | 9 ppm | 2004 | 2.21 | 0/0 |
| | | | 1997 | 3.5 | 0/0 | | | | 2005 | 2.09 | 0/0 |
| | | | 1998 | 4 | 0/0 | | | | 2006 | 2.09 | 0/0 |
| | | | 1999 | 3.7 | 0/0 | | | | 2007 | 1.6 | 0/0 |
| | | | 2000 | 3.2 | 0/0 | | | | 2008 | 2.29 | 0/0 |
| Nitrogen Oxides | 25 ppm – 1 hr | 0.05 ppm – annual | 1996 | 0.08 | 0/0 | Nitrogen Oxides | 0.18 ppm – 1 hr | 0.1 ppm – 1 hr | 2004 | 0.063 | 0/0 |
| | | | 1997 | 0.07 | 0/0 | | | | 2005 | 0.066 | 0/0 |
| | | | 1998 | 0.08 | 0/0 | | | | 2006 | 0.107 | 0/0 |
| | | | 1999 | 0.1 | 0/0 | | | | 2007 | 0.069 | 0/0 |
| | | | 2000 | 0.07 | 0/0 | | | | 2008 | 0.062 | 0/0 |
| Sulfur Dioxide | 0.05 ppm – 1 hr | 0.14 ppm – 24 hr | 1996 | 0.008 | 0/0 | Sulfur Dioxide | 0.04 ppm – 24 hr | 0.14 ppm - 24 hr | 2004 | 0.006 | 0/0 |
| | | | 1997 | 0.007 | 0/0 | | | | 2005 | 0.007 | 0/0 |
| | | | 1998 | 0.005 | 0/0 | | | | 2006 | 0.007 | 0/0 |
| | | | 1999 | 0.007 | 0/0 | | | | 2007 | 0.006 | 0/0 |
| | | | 2000 | 0.008 | 0/0 | | | | 2008 | 0.004 | 0/0 |

Notes: ppm = parts per million µg/m3 = micrograms per cubic meter

Violation days = number of days exceeding State or federal standard

Source: California Air Resources Board, Air Quality Data, 1996–2000.

Notes: ppm = parts per million µg/m3 = micrograms per cubic meter

Violation days = number of days exceeding State or federal standard

Source: CARB 2010a.

### 3. Air Quality Impacts Associated with High Speed Trains

The air quality analysis in the 2008 Bay Area to Central Valley EIR/EIS includes the most recent analysis of criteria pollutant and GHG impacts associated with the proposed HST system. (2008 Bay Area to Central Valley EIR/EIS, pp. 3.3-1 to 3.3-29.) The 2008 analysis considers potential statewide, regional, and localized air quality impacts, and calculates changes in VMT as a result of the HST system. (Id., p. 3.3-8.) At the local level, the 2008 Bay Area to Central Valley EIR/EIS calculated trip generation in the vicinity of HST station locations, including the Transit Center, based on the forecast 2030 demand for high-speed rail. (Id., pp. 3.3-11, 3.1-2.) This Section III.A incorporates by reference the air quality analysis performed in the 2008 Bay Area to Central Valley EIR/EIS as part of the analysis of the impacts associated with providing HST service to the Transit Center.

***Regional Criteria Pollutant Emissions Analysis from High Speed Trains***

The 2008 Bay Area to Central Valley EIR/EIS calculated regional emissions of criteria pollutants and GHGs under No Project and proposed project conditions. (2008 Bay Area to Central Valley EIR/EIS, pp. 3.3-16 to 3.3-21.)

The regional pollutant emissions were estimated based on changes in miles traveled by on-road motor vehicles, airplanes, and trains that would occur as a result of the HST project compared to the No Project alternative. (Id., pp. 3.3-16 to 3.3-17.) The HST system will be powered by the state's electricity grid. Because the grid will supply the power, and no dedicated generating facilities are proposed, no source facilities were identified as part of the HST project. (Id., p. 3.3-9.) Emission changes from power generation were therefore predicted on a statewide level only. In addition, because of the state requirement that an increasing portion of electricity generated for the state's power portfolio must come from renewable energy sources, the emissions generated for the HST system are expected to be lower in the future compared to emissions generated based on the state's current power portfolio. (Id., p. 3.3-9.)

Based on the analysis in the 2008 Bay Area to Central Valley EIR/EIS, the Bay Area to Central Valley HST system would have a significant beneficial effect on air quality because it is predicted to result in reduced emissions of carbon monoxide, $PM_{10}$, $PM_{2.5}$, nitrogen oxides, total organic gases ("TOG"), and carbon dioxide compared to the No Project alternative. (Id. p. 3.3-17.) Table 5 summarizes the emission decreases from the Pacheco Alignment alternative compared to the No Project alternative in terms of percent change. (See Id., p. 3.3-21.)

**Table 5. Potential Statewide Impacts to Air Quality and Greenhouse Gases from the Pacheco Alignment Alternative**

| | Percent Change from No Project | | | | | |
|---|---|---|---|---|---|---|
| **Air Basin** | **CO** | **$PM_{10}$** | **$PM_{2.5}$** | **NOx** | **TOG** | **$CO_2e$** |
| San Francisco Bay | -23.9 | -18.9 | -15.2 | -13.3 | -13.7 | NA |
| San Joaquin Valley | -5.0 | -7.0 | -6.6 | -4.8 | -5.0 | NA |
| **State Total** | **-5.2** | **-5.4** | **-5.6** | **-4.2** | **-5.2** | **-1.4** |

***GHG Emissions***

Based on the analysis in Section 3.3 of the 2008 Bay Area to Central Valley EIR/EIS, the proposed HST system would result in beneficial impacts related to GHG and global climate change. (2008 Bay Area to Central Valley EIR/EIS, p. 3.3-22.) Any additional $CO_2e$ entering the atmosphere, whether due to emissions from construction of the HST system, emissions from operation of the system, or removal of carbon sequestering plants (including agricultural crops), would be more than offset by the beneficial reduction of $CO_2e$ resulting from the reduction in automobile VMT (mobile sources) and in the number of airplane trips as a result of the HST system. (Id., pp. 3.3-22, 3.3-28.)

***Air Quality Conformity***

The 2004 EIS evaluated air quality conformity following the Transportation Conformity Rule, while the 2008 Bay Area to Central Valley EIR/EIS evaluated air quality conformity following the General Conformity Rule.

The 2004 EIS found that the Transbay Program conforms to applicable air quality plans pursuant to USEPA's Transportation Conformity regulations, and this Reevaluation confirms that this is still the case. (2004 EIS, p. 5-61.) FTA's 2005 ROD determined that the 2004 EIS adequately supported this conformity determination. (FTA, ROD, pp. 14-15.) Because the most recent HST ridership information (Section II.D above) indicates that the VMT (and thus air quality emissions) would decrease, HST service to the Transit Center would not affect this determination. Provision of HST service to the Transit Center is included in the most recent regional transportation plans for years 2030 and 2035. (Metropolitan Transportation Commission, Final Transportation 2030 Plan for the San Francisco Bay Area (Feb. 2005), Appendix 1: [Projects by County], p. 81; Metropolitan Transportation Commission, Final Transportation 2035 Plan for the San Francisco Bay Area, (April 2009), Appendix 1: [Projects by County], p. 91.)

A new federal conformity rule regarding $PM_{2.5}$ (40 C.F.R. 93.116) took effect on April 23, 2010. This rule is specifically for Transportation Conformity and is intended to ensure no violations of the $PM_{2.5}$ standard would occur as a result of the project. The train box would not be a source of $PM_{2.5}$ emissions, and thus will not be inconsistent with the new rule.[7]

The HST system, including the provision of HST service to the Transit Center, was evaluated by CHSRA and FRA in the 2008 Bay Area to Central Valley EIR/EIS with respect to General Conformity, the purpose of which is to ensure that any federal action would not cause or exacerbate an exceedence of the NAAQS. (2008 Bay Area to Central Valley EIR/EIS, pp. 3.3-1 to 3.3-2, 3.3-28.) General Conformity applicability is based on a project's potential to exceed the *de minimis* thresholds for non-attainment pollutants, which are based on the severity of an area's non-attainment classification. The 2008 Bay Area to Central Valley EIR/EIS found that the project is consistent with General Conformity because the HST system would not result in an emission increase greater than the General Conformity *de minimis* levels; rather, it would reduce emissions of criteria pollutants. (2008 Bay Area to Central Valley EIR/EIS, p. 3.3-28 and Table 3.3-2, p. 3.3-11.) Because the HST system lowers emissions, it conforms to the Clean Air Act's purpose of meeting ambient standards. The 2008 Bay Area to Central Valley EIR/EIS states that "the program level analysis in this document reviews the potential statewide impacts of a proposed HST system, and the analysis would support determination of conformity for the proposed HST system." (Id., p. 3.3-28.). Therefore, provision of HST service to the Transit Center is consistent with General Conformity.

[7] A dispersion modeling analysis was performed in the 2004 EIS for the bus storage garage portion of the Transbay Program because it would be an area with a concentrated amount of diesel engine sources, and is the only substantial source of $PM_{2.5}$ emissions. (2004 EIS, pp. 5-57 to 5-61.) The modeling in the 2004 EIS showed this component of the Transbay Program would not cause a violation of the $PM_{2.5}$ ambient air quality standard. (2004 EIS, p. 5-60.)

## B. Transportation

Section 5.19 of the 2004 EIS analyzed the transportation impacts of the Transbay Program, including the Transit Center and train box, for the following topic areas:

- Transit operations and corridor transit patronage
- Vehicular traffic
- Parking
- Non-motorized traffic

A summary of the findings from the 2004 EIS is provided below.

**Transit operations and corridor transit patronage**. The assessment of transit operations indicated that the Transbay Program would result in only minor modifications to transit vehicle access and circulation requirements as a result of the new ramp configurations. With the extension of Caltrain to the Transit Center, ridership on other transit service providers would change slightly, and would not require increases in service. The extension of Caltrain service to the Transit Center is still intended and planned for Phase 2 of the Transbay Program. Overall, no significant impacts to transit resulting from the Transbay Program were identified.

**Vehicular traffic**. On a corridor-wide basis, vehicular travel times and VMT within the Caltrain corridor would decrease because of increased Caltrain ridership as a result of the DTX to the Transit Center. Nevertheless, the additional vehicles generated by the Transbay Program, in combination with other development in the downtown San Francisco area, would contribute to significant and unavoidable cumulative impacts on 2020 levels of service at seven downtown intersections (2004 EIS, p. 7-7).

**Parking**. The Transbay Program would eliminate the off-street parking currently provided at the Transbay Terminal and would generate additional parking demand from the redevelopment parcels. The proposed enhancements to transit service may help off-set these shortfalls by reducing area-wide parking demand. In addition, parking shortfalls are considered to be social effects rather than impacts on the physical environment, as the 2004 EIS found (p. 5-146);[8] therefore, no significant impacts to parking resulting from the Transbay Program were identified.

**Non-motorized traffic**. With the Transbay Program, increases in bicyclist activity were projected; however, these increases were not considered substantial in the context of the existing activity levels and the provision of bicycle facilities. The evaluation of pedestrian levels of service indicated that although several crosswalks and intersection corner locations would operate with unacceptable conditions in the future, the Transbay Program would not have a considerable contribution to the unacceptable conditions. Overall, no significant impacts to non-motorized traffic resulting from the Transbay Program were determined.

[8] This approach is also consistent with recent amendments to the Guidelines implementing the California Environmental Quality Act that took effect on March 18, 2010, which deleted parking from the "Appendix G" questionnaire used to screen proposed projects for potentially significant impacts. (See California Code of Regulations, title 14, § 15000 et seq., Appendix G, § XVI.) In addition, the San Francisco Planning Department typically does not consider parking shortfalls or unmet parking demand as potentially significant impacts on the environment, and instead considers them to be primarily social effects.

As explained below, constructing the train box and bringing HST service into the train box would not change these conclusions, because additional transit riders and parking demand would not cause new significant impacts on the environment; pedestrian levels of service would not worsen; and transit operations, bicycle conditions, and corridor travel characteristics would not change. Although the proposed HST system would contribute to unacceptable future intersection levels of service at certain intersections, these intersections would operate at unacceptable levels of service with or without the additional traffic related to HST service because of the projected change in future (2030) conditions in the study area. The effect of the Transbay Program on intersection levels of service was identified as a significant and unavoidable impact in the 2004 EIS (p. 7-7).

## 1. Transportation Affected Environment Updates

This section updates the methodological changes that have been instituted since the 2004 EIS was completed. These updates have an effect on the impact analysis and change the way the impact analysis was performed.

### *Local Standards and Methodology*

After the 2004 EIS was completed, the San Francisco Planning Department implemented modifications to the transportation analysis methodology and approach for environmental review documents for projects within the City. These modifications are summarized as follows:

- The San Francisco Planning Department's Transportation Impact Guidelines for Environmental Review from October 2002 was formally adopted.
- The intersection and pedestrian Level of Service methodology was updated from the 1994 Highway Capacity Manual to the 2000 Highway Capacity Manual.
- The future horizon year has been extended from 2020 to 2030. The new 2030 future cumulative conditions are based on the most recent version of the San Francisco County Transportation Authority's travel demand model (from 2009). This model includes the latest transportation network changes and land use forecasts for San Francisco and the Bay Area, including the recently proposed Transit Center District Plan and its associated proposed rezoning and roadway modifications.

## 2. Transportation Impact Reevaluation

### *Transit Operations*

The transit operations analysis in the 2004 EIS considered terminal capacity, bus access, internal bus circulation, on-street bus circulation, bus storage, and bus operating costs. The proposed HST system would not affect the design and configuration of the access and circulation plans for any transit operator that would serve the Transit Center, and would not affect the operators' storage and operating costs (which are not physical impacts in any case); therefore, there would be no change in the significance of transit operations impacts.

### *Corridor Transit Patronage*

The 2004 EIS included qualitative and quantitative estimates of the changes in transit ridership as a result of the extension of Caltrain to the Transit Center. Overall, it was estimated that there likely would be decreases in ridership on BART to the South Bay, SamTrans, and San Francisco Muni, which would reduce service requirements for these operators. Ridership on BART to the East Bay, AC Transit, and Golden Gate Transit could increase as a result of the increased connectivity between the providers (2004 EIS, pp. 5-136 through 5-138).

The addition of HST service would bring more riders (in addition to any new riders resulting from Caltrain service) to the transit providers that directly serve the Transit Center and those that operate nearby, including AC Transit, BART to the East Bay, Golden Gate Transit, and San Francisco Muni. Based on the most recent HST ridership estimates (see Section II.D), the following ridership increases are projected for each operator in 2035 from HST riders, which is the horizon year for HST ridership projections:

- Muni = 12,000 riders per day
- BART to/from East Bay = 2,000 riders per day
- AC Transit = 2,000 riders per day
- Golden Gate Transit = 1,000 riders per day

In general, all transit operators have the available capacity to accommodate additional riders within their current operating plans, or they have the ability to increase service levels accordingly. Increases in transit ridership are not normally considered impacts on the physical environment when they can be accommodated without the need for construction of new physical infrastructure. Therefore, there would be no change in the significance of transit patronage impacts as a result of HST service.

***Vehicular Traffic***

The vehicular traffic analysis in the 2004 EIS assessed three main categories: vehicular travel time impacts, VMT impacts, and intersection level of service conditions at key intersections around the Transit Center.

The proposed HST system would not affect the shifting of trips from private vehicles to Caltrain, and may result in the further shifting of trips from private vehicles to the new HST service. Therefore, there would be increased beneficial effects on vehicular travel time.

Similarly, the proposed HST system would not affect the decrease in distance of travel by private vehicles in the corridor as a result of the extension of Caltrain, and would result in further decreases in VMT with the new HST service. Therefore, there would be increased beneficial effects on VMT.

The 2004 EIS assessed weekday PM peak hour traffic conditions at 27 key intersections within the study area. In general, intersection operating conditions are described by the concept of Level of Service ("LOS"), which is a qualitative measure of the performance of the intersection based on the average delay per vehicle (measured in seconds per vehicle). Intersection levels of service range from LOS A (representing excellent or free-flow conditions) to LOS F (representing poor or severely congested conditions). In the 2004 EIS, LOS E and LOS F were considered to be unacceptable, and the Transbay Program was considered to result in a significant traffic impact if it caused intersection operating conditions to worsen from LOS D or better to LOS E or LOS F, or from LOS E to LOS F. In addition, under future cumulative conditions, the Program was considered to result in a significant impact if it had a considerable contribution to the growth in traffic volumes at an intersection critical movement (defined as a movement that dictates the overall intersection operations).

A detailed evaluation of the projected HST system ridership was conducted to estimate the number of new vehicle, transit, pedestrian and other trips generated by HST service into the train box. Information obtained from CHSRA and data on existing travel characteristics within downtown San Francisco was used to factor the projected daily ridership values to boardings and alightings for the weekday PM peak hour (Table 6 and Table 7). The ridership values were then assigned to the various primary travel modes (such as taxi, drive and park, or pedestrian). For each primary mode of travel, the mode of travel for HST riders as they actually enter or exit the Transit Center was then

determined as follows: vehicle (pick-up/drop-off or taxi); transit (Golden Gate Transit, SamTrans, AC Transit, and some Muni bus lines); and pedestrian (i.e., walking as a primary mode or walking to a parked vehicle or other transit service). It should be noted that these are conservative assumptions, both because they assume full 2035 projected ridership by the 2030 analysis year and because the assumed number of HST passengers was rounded up from 48,200 to 50,000. A summary of the methodology used to determine the number of new vehicles generated by HST service into the train box is included in Appendix B.

**Table 6. Summary of PM Peak Hour Boarding Calculations, 2035**

| Origin/Destination Market | Daily Boardings | Peak Hour as Percent of Daily | PM Peak Southbound Peaking Factor | PM Peak Boardings |
|---|---|---|---|---|
| Inter-Regional | 20,600 | 12% | 1.0 | 2,472 |
| Local | 4,400 | 17% | 1.2 | 898 |
| **Total** | **25,000** | | | **3,370** |

**Table 7. Summary of HST Passenger Modes of Travel, 2035**

| Source | Pick-up or Drop-off | Drive and Park Own Vehicle | Rental Car | Taxi | Transit or Shuttle | Bike and Walk | Total |
|---|---|---|---|---|---|---|---|
| Original CHSRA Estimates | 13% | 14% | 7% | 9% | 27% | 30% | 100% |
| Revised Estimates | 13% | 12% | 0% | 10% | 33% | 32% | 100% |

In the 2004 EIS, Transbay Program-related impacts were assessed under future year 2020 cumulative scenarios. Under the 2020 Cumulative scenario, 13 of the 27 study intersections were projected to operate at LOS E or LOS F conditions. An examination of the traffic volumes for the movements that determine overall intersection performance was conducted to determine if the Transbay Program would have a considerable contribution at these locations. Overall, the Transbay Program was determined to have a significant traffic impact at 7 of the 13 LOS E and LOS F locations, based on its considerable contribution to the unacceptable operating conditions:

- First Street/Market Street
- First Street/Mission Street
- First Street/Howard Street
- Fremont Street/Howard Street
- Beale Street/Howard Street
- Second Street/Folsom Street
- Second Street/Bryant Street

To account for the changes to the existing roadway network and the future development proposed in downtown San Francisco and the rest of the City and the region, new 2030 cumulative conditions were assessed to determine if the proposed HST system would result in any new significant traffic

impacts. The 2030 cumulative conditions were based on the latest run of the SFCTA travel demand model, and include the San Francisco Planning Department's most recent land use projections for San Francisco. These land use projections include the proposed rezoning of nearby parcels as part of the San Francisco Planning Department's proposed Transit Center District Plan. Accordingly, the future roadway network also includes the lane modifications and roadway network changes proposed in the Public Realm Plan component of the Transit Center District Plan. In addition, the future road network includes the lane changes proposed in the San Francisco Bicycle Plan adopted in June 2009. Together, these represent 2030 No Project conditions.

Three types of new vehicle trips associated with the proposed HST system were analyzed: passengers that drive and park at a nearby parking facility, passengers that are dropped-off or picked-up at the Transit Center, and taxis that drop off or pick up passengers at the Transit Center. These vehicles were manually assigned to the local and regional roadway network to develop the 2030 Plus Project conditions.

Table 8 presents the 2030 No Project conditions at the 27 analysis intersections for the weekday PM peak hour, which includes Caltrain riders, and 2030 Plus Project at the same intersections for the weekday PM peak hour, which includes additional riders associated with HST.

**Table 8. Intersection Level of Service – 2030 Cumulative Conditions, Weekday PM Peak Hour**

| No. | Intersection | 2030 No Project | | 2030 Plus Project | |
|---|---|---|---|---|---|
| | | Delay | LOS | Delay | LOS |
| 1 | First/Market | >80.0 | F | >80.0 | F |
| 2 | Fremont/Market | >80.0 | F | >80.0 | F |
| 3 | Second/Mission | 27.6 | C | 28.8 | C |
| 4 | First/Mission | >80.0 | F | >80.0 | F |
| 5 | Fremont/Mission | >80.0 | F | >80.0 | F |
| 6 | Beale/Mission | >80.0 | F | >80.0 | F |
| 7 | Main/Mission | >80.0 | F | >80.0 | F |
| 8 | Second/Howard | >80.0 | F | >80.0 | F |
| 9 | First/Howard | >80.0 | F | >80.0 | F |
| 10 | Fremont/Howard | >80.0 | F | >80.0 | F |
| 11 | Beale/Howard | >80.0 | F | >80.0 | F |
| 12 | Main/Howard | >80.0 | F | >80.0 | F |
| 13 | Spear/Howard | 44.5 | D | 45.8 | D |
| 14 | Second/Folsom | >80.0 | F | >80.0 | F |
| 15 | First/Folsom | >80.0 | F | >80.0 | F |
| 16 | Fremont/Folsom/ I-80 WB Off-ramp | >80.0 | F | >80.0 | F |
| 17 | Beale/Folsom | >80.0 | F | >80.0 | F |

**Table 8. Intersection Level of Service – 2030 Cumulative Conditions, Weekday PM Peak Hour**

| | | | | | |
|---|---|---|---|---|---|
| 18 | Main/Folsom | >80.0 | F | >80.0 | F |
| 19 | Spear/Folsom | >80.0 | F | >80.0 | F |
| 20 | Embarcadero/Folsom | >80.0 | F | >80.0 | F |
| 21 | Second /Harrison | >80.0 | F | >80.0 | F |
| 22 | Essex/Harrison | >80.0 | F | >80.0 | F |
| 23 | First/Harrison/I-80 EB On-ramp | >80.0 | F | >80.0 | F |
| 24 | Fremont/Harrison | >80.0 | F | >80.0 | F |
| 25 | Main/Harrison | 73.6 | E | 73.6 | E |
| 26 | Spear/Harrison | >80.0 | F | >80.0 | F |
| 27 | Second/Bryant | 68.0 | E | 77.9 | E |

Under 2030 No Project conditions, 25 of the 27 intersections are projected to operate at LOS E or LOS F conditions. In general, future conditions are anticipated to substantially worsen as a result of the increase in development proposed in the area and the street modifications (which would generally reduce capacity) proposed in the Transit Center District Plan and San Francisco Bicycle Plan.

With the addition of the vehicles generated by HST service into the train box, all 27 study locations would continue to operate at the same Levels of Service (i.e., Levels of Service at these intersections would not worsen as a result of HST service). The letter grade for an intersection Level of Service is defined as a specified range in values of the average delay per vehicle at the intersection (e.g., LOS D represents delays between 35 and 55 seconds). Although the addition of vehicles generated by HST service would result in increases in delays at some study intersections, (see Table 8 and Appendix B), these increases would not be great enough to cause a worsening of the LOS letter grade. Therefore, there would be no direct impacts to intersection operating conditions.

A detailed review of the contribution of HST passengers to the intersections' critical movements was performed to determine whether HST service into the train box would have a significant impact when added, along with all Transit Center traffic, to future cumulative conditions. This analysis was conducted using the San Francisco Planning Department's methodology and approach for the determination of cumulative impacts, as documented in San Francisco's *Transportation Impact Analysis Guidelines for Environmental Review* (October 2002).[9] At each study intersection that was projected to operate at LOS E or LOS F under 2030 cumulative conditions, the number of vehicles that the HST passengers would add to poorly-performing critical movements was calculated using this methodology. Based on the amount of the contribution to these movements and the movements' percentage of the total intersection volumes, it was determined whether HST service into the train box would contribute to significant cumulative impacts at some of the study area intersections.

[9] Appendix B presents calculations for the percentage contribution of HST-related traffic at the intersections that would operate at LOS E or LOS F.

Overall, it was determined that HST service into the train box would result in a cumulatively considerable contribution to an already unacceptable level of service at the following intersections:

- First Street/Market Street
- First Street/Mission Street
- Beale Street/Mission Street
- Main Street/Mission Street
- Second Street/Howard Street
- First Street/Howard Street
- Fremont Street/Howard Street
- Second Street/Folsom Street
- Fremont Street/Folsom Street
- Second Street/Harrison Street

These intersections would operate at an unacceptable level of service (LOS F) in 2030 with or without the contribution from passengers of HST service into the train box.

A comparison of significant impacts from the 2004 EIS and the current analysis with the inclusion of the HST service into the train box is shown in Table 9.

**Table 9. Determination of Project Significant Traffic Impacts**

| Intersection | 2004 EIS | Current Analysis with HST System |
|---|---|---|
| First/Market | Significant Impact | Significant Impact |
| First/Mission | Significant Impact | Significant Impact |
| Beale/Mission | – | Significant Impact |
| Main/Mission | – | Significant Impact |
| Second/Howard | – | Significant Impact |
| First /Howard | Significant Impact | Significant Impact |
| Fremont/Howard | Significant Impact | Significant Impact |
| Beale/Howard | Significant Impact | – |
| Second/Folsom | Significant Impact | Significant Impact |
| Fremont/Folsom | – | Significant Impact |
| Second/Harrison | – | Significant Impact |
| Second/Bryant | Significant Impact | – |

HST service into the train box would contribute to significant cumulative traffic impacts at five intersections that were not identified in the 2004 EIS. Previously identified significant traffic impacts at two intersections (Beale Street/Howard Street and Second Street/Bryant Street) that were identified in the 2004 EIS would no longer occur under 2030 cumulative conditions.

Four of the five newly affected intersections—Beale Street/Mission Street, Main Street/Mission Street, Second Street/Howard Street, and Fremont Street/Folsom Street—were projected in the 2004

EIS to operate at LOS D or better under 2020 Cumulative conditions; therefore, no significant impacts were identified. Under the 2030 cumulative analysis, however, these intersections would operate at LOS E and LOS F conditions as a result of the projected increase in traffic in the study area and the roadway network modifications included in the proposed Transit Center District Plan without Transit Center-related traffic. While HST service into the train box will contribute to these significant cumulative impacts, the unacceptable future levels of service at these intersections would occur with or without the increase in traffic volumes generated by HST service into the train box as a result of projected future development in the area.

The intersection of Second Street/Harrison Street, the fifth newly identified intersection, was projected to operate at LOS F under 2020 Cumulative conditions in the 2004 EIS, but the Transbay Program was determined not to have a cumulatively considerable contribution. However, the 2030 cumulative conditions now include new bicycle lanes along northbound and southbound Second Street as proposed in the San Francisco Bicycle Plan. Implementation of these bicycle lanes would result in the elimination of one northbound and one southbound through travel lane along Second Street, including at the intersection of Second Street and Harrison Street. As a result of the elimination of these through lanes, the northbound and southbound approaches (at which the HST service would add vehicles) would become the critical approaches, as they would contain the critical movements that cause the intersection's poor operating conditions. Because the proposed bicycle lanes on Second Street were not part of the cumulative context at the time the 2004 EIS was prepared, the northbound and southbound approaches were not critical and the Transbay Program contributions were not cumulatively considerable.

The 2004 EIS identified the effects of the Transbay Program on intersection levels of service as a significant and unavoidable impact. Although there would be changes in the significance of traffic impacts to which HST service would contribute, these changes would occur with or without the traffic generated by HST service into the train box. In general, these changes are primarily due to the differences between the 2020 cumulative future traffic and roadway conditions analyzed in the 2004 EIS and the current analysis, which is based on updated, projected cumulative future conditions in 2030.

***Parking***

As documented in the 2004 EIS, the Transbay Program would cause the removal of almost 2,000 public and private parking spaces at or near the existing Transbay Terminal. As part of the Transbay Program, the proposed new development on the redevelopment parcels would result in new parking demand and the elimination of additional off-street parking lots. The HST service into the train box would not affect the provision or removal of any off-street parking facilities, nor would it affect the loss in spaces or parking demand associated with the redevelopment parcels.

With the overall net loss in parking in the area, which has already begun as part of ongoing implementation of the Transbay Program, vehicles that would have parked in these displaced spaces would need to seek other parking facilities in the area, park further away from their destinations, or shift modes to non-auto uses. HST service into the train box would generate additional parking demand (estimated to be about 250 spaces), and would not provide any additional parking. However, as identified in the 2004 EIS (p. 5-146), parking shortfalls are considered to be social effects rather than impacts on the physical environment. Therefore, there would be no change in the significance of parking impacts.

*Non-motorized Traffic*
The 2004 EIS considered the effects of the Transbay Program on bicycle and pedestrian conditions in the area.

Overall, it was estimated that there would be increases in bicyclists on the streets surrounding the Transit Center as a result of general background growth in downtown San Francisco, growth generated by development of the redevelopment parcels, and the provision of additional transit service at the Transit Center. HST service into the train box would add to these bicycle volumes, because a portion of the new HST riders (about 1% or approximately 480 riders per day) would travel to and from the Transit Center on bicycle.

The 2004 EIS assessed bicycles added to the streets as a result of AC Transit and Caltrain ridership, and concluded that the existing bicycle facilities plus proposed future bike lane extensions would adequately accommodate bicycling around the Transit Center. (2004 EIS, p. 5-158.) This analysis was updated to include HST riders traveling to and from the Transit Center on bicycles, and the current and proposed bicycle lanes and routes in the area, as described in the recently approved San Francisco Bicycle Plan. With the addition of the 480 daily bicyclists commuting to and from HST, it is still anticipated that the bicycle lanes and routes around the Transit Center would accommodate these bicycle volumes. The 2004 EIS estimated that 232 bicycle parking spaces would be needed at the Transit Center to accommodate AC Transit and Caltrain riders commuting by bicycle. (2004 EIS, p. 5-158.) Assuming every HST rider who arrives by bicycle will require bicycle storage at the Transit Center (which is a conservative assumption), an additional 240 bicycle storage spaces would be required at the Transit Center, for a total of 472 spaces. The current design of the Transit Center includes secured, staffed, and enclosed bicycle storage facilities for a minimum of 500 bicycles. Therefore, the planned bicycle facilities at and around the Transit Center would accommodate the bicycle ridership projections for HST, and there would be no change in the significance of bicycle impacts.

In addition, the 2004 EIS included a detailed evaluation of pedestrian operations at the corners and crosswalks of key intersections adjacent to the Transit Center for weekday PM peak hour conditions. Similar to intersection conditions, pedestrian conditions are described using the concept of Level of Service, which is based on the amount of space (in terms of square feet) each pedestrian has at the selected corner or crosswalk. Pedestrian corner and crosswalk levels of service range from LOS A (representing excellent or free-flow conditions) to LOS F (representing poor or severely congested conditions). In the 2004 EIS, LOS F was considered to be unacceptable.

In the 2004 EIS, Program-related impacts were assessed under future year 2020 cumulative scenarios. Under the 2020 Cumulative scenario, two study crosswalks and eleven study corners were projected to operate at LOS F conditions, and thus would operate at an unacceptable level of service with or without the Transbay Program (2004 EIR, pp. 5-146 to 5-152). An examination of the proportion of the pedestrian volumes at each location was conducted to determine if the Transbay Program would have a significant impact at these locations. The 2004 EIS concluded that the additional pedestrian traffic resulting from the Transbay Program would not have a significant impact or create a significant contribution to these future cumulative conditions (2004 EIS, p. 5-156).

To account for the changes to the projected future development and the changes to the roadway network and pedestrian facilities proposed in downtown San Francisco, updated 2030 cumulative conditions were assessed to determine if the proposed HST system would result in any new significant pedestrian impacts. The 2030 cumulative conditions were based on the most recent San Francisco County Transportation Authority ("SFCTA") travel demand model and include the San Francisco Planning Department's most recent land-use projections for San Francisco. These land-use

projections include the rezoning of nearby parcels proposed in the San Francisco Planning Department's Transit Center District Plan. In addition, the future pedestrian network includes the modifications to the area sidewalks and crosswalks proposed in the Public Realm Plan component of the Transit Center District Plan, which includes modifications to sidewalks and crosswalks along Mission Street, Howard Street, Fremont Street, First Street, and Beale Street. Together, these represent 2030 No Project conditions.

Three types of new pedestrian trips associated with the proposed HST system were analyzed: passengers that walk to and from their parked vehicles, passengers that walk to and from transit service, and passengers that walk as their primary mode of travel. These pedestrians were manually assigned to the study crosswalks and corners to develop the 2030 Plus Project conditions.

Tables 10 and 11 present the 2030 No Project and 2030 Plus Project conditions at the five analysis intersections for the weekday PM peak hour. Note that these conditions do not assume the potential pedestrian tunnel between the Transit Center and Market Street described as part of the locally preferred alternative analyzed in the 2004 EIS (pp. 2-41, 5-147 and 5-153), which would have the effect of reducing street level pedestrian trips in some locations.

**Table 10. Crosswalk Level of Service – 2030 Cumulative Conditions, Weekday PM Peak Hour**

| | | 2030 No Project | | 2030 Plus Project | |
|---|---|---|---|---|---|
| **Intersection** | **Crosswalk** | **Circulation Area (sq ft)** | **LOS** | **Circulation Area (sq ft)** | **LOS** |
| First/Mission | N | 29 | C | 24 | C |
| | E | 15 | E | 13 | E |
| | S | 13 | E | 11 | E |
| | W | 11 | E | 9 | E |
| Fremont/Mission | N | 11 | E | 9 | E |
| | E | 14 | E | 11 | E |
| | S | 12 | E | 9 | E |
| | W | 13 | E | 11 | E |
| First/Howard | N | 29 | C | 23 | D |
| | E | 36 | C | 28 | C |
| | S | 30 | C | 24 | D |
| | W | 4 | F | 3 | F |
| Fremont/Howard | N | 29 | C | 22 | D |
| | E | 35 | C | 29 | C |
| | S | 32 | C | 25 | C |
| | W | 56 | B | 41 | B |
| Beale/Folsom | N | 194 | A | 182 | A |
| | E | 121 | A | 114 | A |
| | S | 151 | A | 142 | A |
| | W | 126 | A | 116 | A |

**Table 11. Corner Level of Service – 2030 Cumulative Conditions, Weekday PM Peak Hour**

| | | 2030 No Project | | 2030 Plus Project | |
|---|---|---|---|---|---|
| Intersection | Corner | Circulation Area (sq ft) | LOS | Circulation Area (sq ft) | LOS |
| First/Mission | NE | 50 | A | 43 | A |
| | SE | 17 | A | 14 | A |
| | SW | 49 | A | 41 | A |
| | NW | 56 | A | 48 | A |
| Fremont/Mission | NE | 43 | A | 34 | A |
| | SE | 44 | A | 35 | A |
| | SW | 11 | B | 8 | C |
| | NW | 35 | A | 29 | A |
| First/Howard | NE | 105 | A | 82 | A |
| | SE | 132 | A | 103 | A |
| | SW | 141 | A | 111 | A |
| | NW | 122 | A | 95 | A |
| Fremont/Howard | NE | 113 | A | 91 | A |
| | SE | 110 | A | 90 | A |
| | SW | 120 | A | 92 | A |
| | NW | 105 | A | 79 | A |
| Beale/Folsom | NE | 1014 | A | 956 | A |
| | SE | 372 | A | 351 | A |
| | SW | 323 | A | 301 | A |
| | NW | 389 | A | 362 | A |

Under 2030 No Project conditions, one crosswalk location and no corner locations are projected to operate at LOS F conditions. In general, a substantial increase in pedestrian volumes is anticipated as a result of the increase in development proposed in the area. However, the roadway and sidewalk modifications proposed in the Transit Center District Plan would noticeably improve the pedestrian conditions, with wider sidewalks and corner bulbs that increase the amount of space for pedestrians and shorten the walk distances across intersections. Although HST service to the train box would result in additional pedestrian activity, this increased activity would not cause any study location to worsen to LOS F conditions, nor would it result in a significant contribution to cumulative traffic conditions at the locations that were projected to operate at LOS F, according to the applicable impact analysis methodology. Therefore, there would be no change in the significance of pedestrian impacts resulting from the introduction of HST service into the train box.

## C. Noise and Vibration

Sections 5.8 (operational impacts) and 5.21.10 (construction impacts) of the 2004 EIS analyzed the noise and vibration impacts of the Transbay Program, including the Transit Center. The 2004 EIS concluded that there would be no air borne noise impacts resulting from train service to the Transit Center because the trains would enter the Transit Center through an underground tunnel. HST service to the train box would not change this conclusion, because the HST service would be underground on the same tracks.

Operation of the Transbay Program would have significant ground borne vibration impacts at four locations along the DTX. However, the impacts at these locations would be reduced to a less-than-significant level by mitigation identified on page 5-77 of the 2004 EIS.[10] HST service into the train box would not change this conclusion.

As discussed in detail below, although HST service would increase the total number of daily train movements (inbound and outbound), the number of movements would remain within the threshold category analyzed in the 2004 EIS (i.e., "frequent"), the per event level of noise and vibration would not increase, and there would be no change in the location of the train box in relationship to sensitive receptors. While the level of service proposed for Caltrain would remain essentially unchanged, at 132 train movements per weekday, the total number of train movements per day would increase to as many as 348 for conventional and HST service combined. The CHSRA 2009 Business Plan indicates that daily HST service to the Transit Center will occur over a 16-hour period. During the morning and evening peak periods of 3 hours each, HST will operate approximately 8 trains per hour into and from the Transit Center. During the remaining 10 hours of operation, HST is expected to operate approximately 6 trains per hour into and from the Transit Center. This proposed level of service results in a total of approximately 216 daily HST movements at the Transit Center over a 16-hour period.[11] This change would not result in additional or more severe vibration impacts, because the change in the number of trains per hour is minor and because Mitigation Measure VibO-1 would effectively reduce HST vibration impacts to a less-than-significant level.

The 2004 EIS concluded that the short-term noise and vibration impacts of construction of the Transit Center would be significant. These impacts would be reduced to a less-than-significant level by measures identified in the 2004 EIS that were incorporated into Mitigation Measures NoiC-1 through NoiC-6 and VibC-1 through VibC-6 (2004 EIS, pp. 5-212 to 5-214; MMRP, pp. 2-5), which were adopted and incorporated into the Transbay Program. Constructing the train box and bringing HST service into the train box would not change these conclusions because, as described in Sections II.C and III.D, no changes are proposed with regard to construction of the train box. Mitigation Measures NoiC-1 through NoiC-6 and VibC-1 through VibC-6 would continue to apply to the entire Transbay Program, including the train box, and would mitigate construction vibration and noise impacts to a less-than-significant level.

### 1. Noise and Vibration Affected Environment Update

The potential changes to the Transbay Program associated with the currently proposed HST service into the Transit Center are summarized as follows.

| Project Element | HST Considerations |
|---|---|
| Project Alignment | Both Caltrain and CHSRA trains will use the 3-track tunnel described in the 2004 EIS, which will enter the train box from the west side. The tunnel is not part of Phase 1, but is in Phase 2. |
| Station Design/Train Box | The configuration is similar to the description in the 2004 EIS (see Section II.A). The train box will be approximately 1,500 feet long by 190 feet wide and extend 60 feet below ground. It will be reinforced concrete consisting of two levels. The lower level will have 6 tracks and 3 platforms. The upper level will serve as a train |

[10] The mitigation identified on page 5-77 of the 2004 EIS was adopted and incorporated into the Transbay Program as Mitigation Measure VibO-1.

[11] The number of HSTs that can be processed at the Transit Center is directly related to the proposed train dwell time at the station platform. With shorter dwell times, more trains can be processed. The anticipated HST peak hour level of service at the Transit Center is based on a minimum platform dwell time of approximately 30 minutes.

| | |
|---|---|
| | passenger ticketing and waiting area; both will be connected to the building by stairs, elevators, and escalators. The train box will widen at the west end, where it will connect to the underground rail tunnel. Train speed in the Transit Center and tail tracks will be limited to a maximum of 5 to 10 miles per hour. |
| Train Operations | The 2004 EIS noise and vibration analysis assumed up to 132 conventional train movements per day (inbound and outbound over 24 hours). HST service would add up to 216 train movements per day through the tunnel and into and out of the Transit Center, for a maximum daily total of 348 train movements, at a rate of 8 trains per hour during the 3-hour morning and evening peak periods, and 6 trains per hour during the 10 off-peak hours. |

**2. Air Borne Noise**

The 2004 EIS did not identify impacts from air borne noise because the trains will enter the Transit Center underground from a tunnel (2004 EIS, p. 5-69). The determination of no impact would remain the same with the addition of HST operations, because the high-speed trains also would be in a tunnel. Therefore, there would be no change in the significance of air borne noise impacts.

**3. Ground Borne Noise and Vibration**

The 2004 EIS concluded that impacts from ground borne noise and vibration would be significant at four locations along the DTX and with mitigation would be reduced to a less-than-significant level (2004 EIS, pp. 5-75 to 5-77). HST service would add as many as 8 trains per hour during the 3-hour morning and evening peak periods, and 6 trains per hour during the 10 off-peak hours. This would result in an increase in the total number of train movements in the tunnel and into the Transit Center. While the total number of train movements could increase from up to 132 trains per day for conventional train operations (Caltrain) to as many as 348 movements per day for combined conventional and HST service, over the course of a 16-hour operating day this would amount to only an average of 8 additional train movements per hour during the 3-hour morning and evening peak periods, and 6 trains per hour during the 10 off-peak hours. This change would not result in additional or more severe vibration impacts, because Mitigation Measure VibO-1 would effectively reduce HST vibration impacts to a less-than-significant level.

The changes to ground borne noise impacts would be similar to those for ground borne vibration in that the number of events would increase, but the level of noise per event would not. Because the significance threshold is based on the level of noise per event, rather than the number of events, the 2004 EIS analysis of ground borne noise assumed that the Program would be in the "frequent" category, and the level of noise per event would not increase; therefore, no change to the significance of this impact would occur. (2004 EIS, pp. 5-75 to 5-77.)

The FTA ground borne vibration and ground borne noise impact criteria, from Table 8-1 of the FTA Noise and Vibration Impact Assessment Manual (2006), which has been updated since the 2004 EIS was prepared, are shown in Table 12.[12]

[12] Table 12 is from the 2006 FTA *Noise and Vibration Impact Assessment Manual*. The 2004 EIS used the previous, 1995 edition of the same manual. The ground borne vibration impact criteria for frequent events and the 70 events-per-day definition of "frequent events" are unchanged from the 1995 edition.

**Table 12. Ground Borne Vibration (GBV) and Ground Borne Noise (GBN) Impact Criteria for General Assessment**

| Land Use Category | GBV Impact Levels (VdB re 1 micro-inch /sec) | | | GBN Impact Levels (dB re 20 micro Pascals) | | |
|---|---|---|---|---|---|---|
| | Frequent Events[1] | Occasional Events[2] | Infrequent Events[3] | Frequent Events[1] | Occasional Events[2] | Infrequent Events[3] |
| Category 1: Buildings where vibration would interfere with interior operations. | 65 VdB[4] | 65 VdB[4] | 65 VdB[4] | N/A[4] | N/A[4] | N/A[4] |
| Category 2: Residences and buildings where people normally sleep. | 72 VdB | 75 VdB | 80 VdB | 35 dBA | 38 dBA | 43 dBA |
| Category 3: Institutional land uses with primarily daytime use. | 75 VdB | 78 VdB | 83 VdB | 40 dBA | 43 dBA | 48 dBA |

Notes:

1. "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3. "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
4. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.
5. Vibration-sensitive equipment is generally not sensitive to ground-borne noise.

Source: Table 8-1 from FTA Noise and Vibration Impact Assessment Manual (2006).

The ground borne noise and vibration velocity level metrics used to assess ground borne noise and vibration impacts are calculated (measured or predicted) as the maximum vibration velocity level per event, and are not based on the number of events or movements per day. The impact criteria threshold level values shown in the table are applied based on the number of events per day ("infrequent" is fewer than 30 events per day, "occasional" is between 30 and 70, and "frequent" is more than 70 events per day). Because the 2004 EIS analysis assumed a "frequent" number of events (70 events per day or greater) in the analysis of ground borne noise and vibration impacts (2004 EIS, pp. 5-65 to 5-66), the same threshold would apply to the analysis of additional HST movements. Because the vehicle speeds of both conventional trains and HST in the Transit Center area would be a maximum of 5 to 10 miles per hour (Pers. Comm. Derek Penrice, TJPA DTX Tunnel Design Manager), vehicle-induced ground borne noise and vibrations would be negligible, resulting in no change in the level of each noise and vibration event or in the significance of ground borne noise and vibration impacts.

### 4. Construction Noise and Vibration

The construction activity locations and processes, and the type of construction equipment used, would not change significantly from the assumptions used in the 2004 EIS as a result of the addition of HST service; therefore, construction noise and vibration impacts would remain the same. Mitigation Measures NoiC-01 through NoiC-06 and VibC-01 through VibC-06, which were adopted

and incorporated into the Transbay Program (MMRP, pp. 2-4, 5), would continue to apply and would reduce the impact from construction noise and vibration to a less-than-significant level.

**5. Effectiveness of Noise and Vibration Mitigation**

Mitigation Measure VibO-01 was adopted and incorporated into the Transbay Program (MMRP, p. 4) to reduce the significance of ground borne Caltrain train noise and vibration impacts to a less-than-significant level. While these impacts are not associated with operation of the train box, Mitigation Measure VibO-01 would apply to HST service as well and would also be effective in addressing HST noise and vibration. The effectiveness of the adopted vibration mitigation elements, such as resilient rail fasteners or resiliently supported ties, is dependent upon on the frequency spectrum of the transmitted vibration and may depend on the specific vehicle characteristics. While HST vehicle design characteristics, such as axle loads, suspension stiffness, and operating speed, have not yet been established, it is assumed that the HST vehicles would travel at the same speed entering the train box as the Caltrain vehicles, and Mitigation Measure VibO-01 would be effective for HST vehicles. Additionally, based on current design assumptions, HST vehicles are anticipated to enter the train box at 5 to 10 miles per hour, a speed low enough that there would be no new or more severe impacts from vibration.

## D. Construction

Since 2004, minor changes have been made to construction details of the Transit Center during development of final design. As explained in Section II.C, the FTA found that construction of the Transit Center in either one or two stages would not result in environmental impacts beyond those previously evaluated in the 2004 EIS. The 2004 EIS identified the potential use of tiebacks or struts for temporary excavations. Based on the current design, only struts would now be used, thereby eliminating the need to obtain access underneath other existing structures. The use of struts only for temporary excavation would not result in new or more severe impacts, but would reduce impacts identified in the 2004 EIS.

The analysis of Solid Waste Management in 2004 EIS Section 5.4.2.3 (p. 5-39) remains current, although a new City enactment adopted since 2004 will have the effect of reducing the solid waste generated during construction. City and County of San Francisco Ordinance No. 27-06, which took effect on July 1, 2006, created a mandatory program to maximize the recycling of mixed construction and demolition ("C&D") debris. The ordinance requires that mixed C&D debris must be transported off-site by a registered transporter and taken to a registered facility that can process and divert from landfill disposal a minimum of 65% of the material generated from construction, demolition or remodeling projects. The Transbay Program will comply with this ordinance. Because compliance with this ordinance will result in the diversion of more C&D material from landfills than was anticipated in the 2004 EIS, the Transbay Program's previously evaluated impacts to area landfills would be reduced.

All other construction considerations related to the train box remain substantially similar to those covered in the 2004 EIS. Thus, HST service into the train box would not result in any new significant construction impacts, and no updating of the 2004 EIS is required.

## E. Cumulative Impacts of the HST System

This section summarizes consideration of the cumulative impacts analysis in the 2008 Bay Area to Central Valley EIR/EIS, which analyzes the portion of the California HST system that includes the Transit Center. The FRA is relying on the CHSRA's 2008 Bay Area to Central Valley EIR/EIS because it is the most recently available information on the impacts of high-speed rail. The 2008 Bay

Area to Central Valley EIR/EIS analyzed whether implementation of the Bay Area to Central Valley portion of the HST system, including the Transit Center train box, could result in significant cumulative impacts in combination with closely related past, present, and reasonably foreseeable probable future projects (CHSRA, 2008 Bay Area to Central Valley EIR/EIS, pp. 3.17-1 to 3.17-42). The 2008 Bay Area to Central Valley EIR/EIS found that the HST system could have a cumulatively considerable impact on the following: traffic and circulation and travel conditions; land use compatibility; agricultural land; aesthetics and visual resources; cultural and paleontological resources; biological resources and wetlands; and public parks and recreation resources (Section 4(f) and 6(f) Resources) (CHSRA, 2008 Bay Area to Central Valley EIR/EIS, CEQA Findings of Fact and Statement of Overriding Considerations, pp. 69-72). HST service into the train box either would not contribute to these cumulative impacts, or would not change the prior analysis in the 2004 EIS for the following reasons.

**1. Traffic and Circulation and Travel Conditions**

Section 7.2.2 of the 2004 EIS identified vehicular impacts at seven local intersections as a significant and unavoidable cumulative impact. Future conditions in 2030, with or without HST service to the train box, would contribute to cumulative impacts at different intersections (identified in Section III.B) as a result of the change in future development. These intersections would operate at unacceptable levels of service with or without the contribution of HST passengers as a result of the projected future development; however, the contribution of HST would be cumulatively considerable at some locations. Thus, the Transbay Program would continue to have a significant and unavoidable cumulative impact on intersection levels of service. Mitigation Measure PC 7, which was adopted and incorporated into the Transbay Program and would apply to construction of the train box, would reduce the potential impacts of construction on traffic and transportation to a less-than-significant level (2004 EIS, pp. 5-159 to 5-180, 5-184-5-202; MMRP, p. 20). As discussed in Sections III.D (Construction) and III.B (Transportation) of this Reevaluation, HST service into the train box would not change these conclusions.

**2. Land Use Compatibility**

The 2004 EIS determined that the Transbay Program is compatible with local land use. It would not conflict with local land use plans and policies, divide an established community, result in significant job loss, or have significant environmental justice impacts (2004 EIS, pp. 5-4, 5-13, 5-35 to 5-37). Potential community impacts resulting from property acquisition and construction would be mitigated to a less-than-significant level by Mitigation Measures Prop 1, PC 1-7, and GC 1-5 (2004 EIS pp. 5-34, 5-159 to 5-182, 5-202 to 5-205; MMRP, pp. 1, 18-20). HST service into the Transit Center would not change any of these conclusions, because the Program's land use and footprint remain the same.

**3. Agricultural Land**

The Transbay Program, including the Transit Center, would have no impact on agricultural resources, because there are no agricultural resources in the Transbay Program area (2004 EIS, p. 4-1).

**4. Aesthetics and Visual Resources**

The Transit Center would not have any impacts on aesthetics and visual resources (2004 EIS, pp. 5-112 to 5-114, 7-9). HST service into the Transit Center would not change this conclusion because it would have no effect on the above-ground design of the Transit Center. In addition, the 2004 EIS found that short-term visual changes as a result of construction activities would be less than significant, and these impacts were further reduced by Mitigation Measures VA 1 and VA 2 (2004 EIS, pp. 5-224 to 5-225; MMRP, p. 22). As discussed in Section III.D (Construction) of this Reevaluation, HST service into the train box would not change this conclusion.

**5. Cultural and Paleontological Resources**

The Transbay Program would have a significant impact on archeological resources, but that impact would be mitigated to a less-than-significant level by Mitigation Measures CH 1, CH 2, and CH 15-20 that require preparation of a comprehensive archaeological research design and treatment plan for archeological resources (2004 EIS, pp. 5-86 to 5-89; MMRP, pp. 7-11, 14).

The Transbay Program would have a significant and unavoidable effect on historic resources, and would thus contribute to this cumulative impact (2004 EIS, pp. 5-90 to 5-111, 7-6). Mitigation Measures CH 1-14 and CH 19-20 would not reduce this impact to a less-than-significant level (MMRP, pp. 7-11). Construction of the Transbay Program, including the train box, would continue to contribute to this significant cumulative impact. These impacts would not be increased or otherwise affected by HST service into the train box, however.

**6. Biological Resources and Wetlands**

The Transbay Program would have no impact on biological resources, because no sizable natural habitat for biological plant, animal, or bird species remains in the study area. The Program area is outside of the 100-foot Bay shoreline band, and the U.S. Fish and Wildlife Service has indicated that no adverse effects on endangered species of wildlife and plants are expected from the Transbay Program (2004 EIS, p. 4-39).

**7. Public Parks and Recreation Resources (Section 4(f) and 6(f) Resources)**

The Transbay Program will use Section 4(f) resources through direct acquisition and temporary occupancy. This is because it requires demolition of the Transbay Terminal and loop ramp structures, which are contributing elements of the San Francisco–Oakland Bay Bridge, which is listed on the National Register of Historic Places ("NRHP"), and demolition of three buildings that contribute to a historic district eligible for the NRHP (2004 EIS, pp. 8-1 to 8-2). The 2004 EIS and the FTA ROD found that there is no feasible and prudent alternative to the use of these Section 4(f) resources and that the Transbay Program includes all possible planning to minimize harm resulting from such use (2004 EIS, pp. 8-24; FTA ROD, pp. 15-21). Construction of the Transbay Program, including the train box, would continue to contribute to this significant cumulative impact. These impacts would not be increased or otherwise affected by HST service into the Transit Center.

The Transbay Program would have no impact on Section 6(f) resources, because there are no Section 6(f) resources in the Program area (CHSRA, 2008 Bay Area to Central Valley EIR/EIS, Table 3.16-3, p. 3.16-6).

# IV. UPDATED FINANCIAL ANALYSIS

## A. Current Transit Center Phase 1 Financial Plan

This section summarizes the current Transit Center Phase 1 financial plan. To prepare the 2004 EIS and regularly thereafter, the TJPA's financial consultants have undertaken an iterative financial planning process of assigning revenues that can be reasonably expected to be available and that are eligible for expenditure on the identified contract commitments. The funding plan utilizes grant funds early in the schedule to minimize the gap between non-escalating revenues and cost escalation, conforms to any restrictions on funding, minimizes debt issuance and related financing costs, and utilizes assumptions that are consistent with industry best practices and historical experience. The financial plan will continue to be updated throughout the life of the Program to reflect current conditions.

Since the 2004 EIS, elements of the financial plan have changed. However, the primary financial conclusion of the 2004 EIS still holds: the TJPA has the financial capacity to build, operate, and maintain the Transit Center. To summarize, the following key elements of the financial plan have changed:

- The Transbay Program has been phased to deliver a useable transportation improvement with currently available funding.
- Capital cost estimates have been updated periodically since the 2004 EIS. The Phase 1 cost is estimated at $1.589 billion (year of expenditure ["YOE"]). The Phase 2 cost estimate is under development.
- Capital revenues have been committed and allocated to the project.
- New funding sources, including the federal HSIPR program funds and a capital commitment from AC Transit, have become available.
- The TJPA has secured a TIFIA loan for Phase 1 of the Program.

These and other changes are discussed in the following sections.

## B. Phasing of the Program

In 2005 and 2006, the TJPA, in consultation with the Program Management/Program Controls consultant, conducted a value engineering exercise to identify methods of reducing the overall cost of the Transbay Program and secure the greatest benefit from the funds committed to date. The principal outcome of this process was a recommendation to split the Transbay Program into two phases: Phase 1 included the elements of the Program necessary for bus operations: construction of the temporary terminal; demolition of the existing Transbay Terminal and bus ramps; and construction of the above-grade levels of the Transit Center, the bus ramps, and bus storage. In Phase 1, the TJPA planned to build drilled caisson foundations and other improvements in the Transit Center to allow for future construction of the train box. Phase 2 involved construction of the DTX, the rail extension for Caltrain commuter rail and HST, and the train box. Constructing the above-ground portion of the Transit Center to allow for the later construction of the train box below it is referred to as the top-down method of construction. At its June 2, 2006, meeting, the TJPA Board adopted this phased implementation strategy.

The Transit Center design team headed by Pelli Clarke Pelli Architects designed the Transit Center through Conceptual Validation and Schematic Design assuming that the Transit Center would be built in two phases using the top-down strategy. However, the design team also kept open the possibility that the Transit Center train box could be constructed in Phase 1 if the TJPA were able to secure additional funding. Including the train box in the same phase of construction as the above-ground bus station levels of the Transit Center would change the construction method used for the Transit Center to bottom-up.

On June 11, 2009, the TJPA Board directed staff and the design team to proceed with the bottom-up approach, which will result in significant total Program cost savings, distinct design advantages, and other benefits as described below:

- While adding $400 million to the $1.2 billion cost of Phase 1 of the Transit Center, constructing the train box in Phase 1 will result in an estimated overall savings of $100 million for the Transbay Program. The following factors contribute to these savings: (a) the drilled caissons designed to serve as the future columns of the train box structure under the top-down strategy will not be required; (b) excavation and construction of the train box will be easier and less costly; and (c) building the train box now, in a soft construction market, will result in savings in the cost of labor and materials.
- Constructing the train box during Phase 1 will allow "back of house" systems—electrical transformers and switch gear, mechanical rooms, and other administrative, maintenance and building support spaces essential to the operation of the Transit Center—to be located below grade on the lower concourse level, out of sight and out of the path of ground floor visitors to the Transit Center. The top-down strategy would not allow for below-ground construction other than foundations; accordingly, these systems would have to be located on the ground level, compromising horizontal and vertical circulation and displacing retail and other public uses that will activate the Transit Center. Moreover, some of these systems would have to be reworked during Phase 2 under the top-down strategy.
- Including the train box in Phase 1 will simplify construction and mitigate the construction risks posed by the top-down method. Constructing the train box during Phase 2 would require the contractor to excavate underneath the constructed or partially constructed above-grade levels of the Transit Center, making construction slower and more expensive than conventional open-pit excavation. The contractor would have to carefully monitor and control ground settlement during excavation to protect earlier Transit Center construction; if settlement exceeds projections, the measures required to stabilize the excavation and mitigate the settlement would be more difficult and costly to implement than with bottom-up construction. Additionally, obstacles encountered during the course of bottom-up construction will be easier and less expensive to address, resulting in fewer delays.
- Under the top-down strategy, the vertical control and alignment of the drilled caissons that would serve as the columns of the future rail levels would be challenging, and the columns would require moderate to extensive rework during Phase 2 to produce an acceptable finished alignment. Constructing the train box in Phase 1 allows for the design of the train box as a large bath tub. Constructing the train box in Phase 2 would require the construction of deep foundations to support the Phase 1 structure followed in Phase 2 by the construction of the train box. The penetration of the train box by the Phase 1 foundations would compromise the train box waterproofing systems, resulting in poorer waterproofing performance and long-term maintenance challenges.
- Constructing the train box in Phase 1 will decrease the total time for construction of the Transit Center by several months and reduce the associated disruption of vehicle and pedestrian traffic and access to adjoining properties resulting from the construction.

- Buildings adjacent to the Transit Center will exert loads on the train box during construction. Constructing the train box during Phase 1, before construction of the Transit Tower and other anticipated development on adjoining property, will eliminate the requirement for the train box to provide lateral support for these later structures. Rather, when these structures are built, they will be required to protect the train box.
- Building the train box now during Phase 1, during an economic recession, rather than waiting for several years, will have the added advantage of creating jobs when they are most needed. The TJPA estimates that the train box construction alone will directly and indirectly add 12,000 jobs to the local economy.

## C. American Recovery and Reinvestment Act

On February 17, 2009, President Obama signed into law the American Recovery and Reinvestment Act ("Recovery Act"). The Recovery Act includes $8 billion nationally for high-speed rail and intercity rail grants. On April 16, 2009, the FRA released its *Vision for High-Speed Rail in America*, a strategic plan describing how FRA will use the $8 billion in Recovery Act funds for intercity and high-speed rail. On January 28, 2010, Transportation Secretary LaHood announced his intent to allocate $400 million for the train box in the Transbay Transit Center. In a March 29, 2010, letter to the TJPA, USDOT confirmed that it has reserved $400 million within the overall California allocation of the Department's High Speed Rail grants to provide funding for the train box (Exhibit 6b).

The inclusion of the Recovery Act funds for the train box brings the revised Phase 1 budget to $1.589 billion (YOE).

## D. Capital Plan

### 1. Local and Regional Plans

The Transbay Program is included in numerous local and regional transportation plans. These include:

- Metropolitan Transportation Commission's ("MTC") Resolution 3434: Regional Transit Expansion Plan ("RTEP")
- Regional Transportation Program ("RTP") for Environmental, Preliminary Engineering, and Right of Way phases
- Transportation Improvement Program ("TIP")
- MTC's 2000 Blueprint
- MTC's Transportation 2035 Plan for the San Francisco Bay Area
- San Francisco Countywide Transportation Plan
- San Francisco Countywide Congestion Management Plan
- New Expenditure Plan for San Francisco ("Prop K")
- Expenditure Plan for Regional Measure 2 ("RM 2")
- Transbay Redevelopment Project Area Design for Development

All of these plans included extensive public outreach regarding the inclusion of and prioritization of projects.

Of particular note is MTC's Resolution 3434: RTEP. As part of the 2001 RTP, the MTC approved a consensus agreement on Bay Area transit expansion. Resolution 3434 identifies several rail and bus projects as priorities for transit expansion in the Bay Area. The Transbay Program is included in this list. The RTEP includes an array of funding from federal, state, regional, and local sources and matches funds to projects based on competitiveness and eligibility. The Transbay Program has also been included in the updates of the RTEP.

Inclusion in Resolution 3434 results in increased commitment and advocacy for funding. As noted by MTC's executive director in his report to the MTC commissioners in December 2001, "Although the requirement still remains that only fully funded projects can be included in the RTP under federal law, Resolution No. 3434 confers a separate Commission endorsement regarding long range policy and financial commitments to its projects. That is, the financial commitments of regional discretionary funds outlined in [the] Funding Strategy are equally firm, whether the project is fully or partially funded. As projects secure full resource commitments, they can advance into the RTP."[13]

### 2. Capital Cost Estimates

Since the 2004 EIS, the capital cost estimates for the Transbay Program have been updated periodically. Table 13 presents the Phase 1 cost estimate, which includes the train box.

**Table 13. Transbay Program Phase 1 Cost Estimate as of March 2010**

| Cost Categories | Budget (in $ Millions, YOE) |
|---|---|
| Temporary Terminal | 25.3 |
| Bus Storage | 22.9 |
| Demolition | 16.2 |
| Utility Relocation | 65.6 |
| Transit Center Building Design | 143.1 |
| Transit Center Building Construction | 909.7 |
| Bus Ramps | 40.2 |
| Right of Way Acquisition | 71.9 |
| Right of Way Support | 5.3 |
| Programwide | 243.6 |
| Program Reserve | 45.2 |
| **Total** | **1,589.0** |

Notes: Cost categories based on comments from TIFIA. Cost estimate from Program Management/Program Controls consultant, March 30, 2010

Revisions to the Phase 2 cost estimate are currently under development. In March 2008, the TJPA Board adopted the Phase 2 Baseline Budget of $2.996 billion (YOE). At that time, the Phase 2 budget included all rail components of the Program, including the train box.

[13] Steve Heminger, Executive Director, MTC, Memorandum to Planning and Operations Committee, "RE: Resolution No. 3434: Regional Transit Expansion Program of Projects," Dec. 7, 2001, p. 2.

Since the adoption of the Phase 2 Baseline Budget, preliminary engineering has continued, and other changes have been made to the scope of the DTX. To summarize, the primary changes to Phase 2, which will impact the cost estimate include:

- Acceleration of the train box into Phase 1 and change of construction of the Transit Center to a bottom-up construction methodology;
- Revisions to DTX scope as requested by CHSRA; and
- Completion of DTX Preliminary Engineering, anticipated for summer 2010.

### 3. Funding Sources

The revenues identified for the Transbay Program generally fall into two categories: revenues to be used for capital costs and revenues to be used for repayment of a construction period loan. The revenues to be used for capital costs are grants, land sales proceeds, lease income from acquired right of way parcels,[14] and other one-time revenue generation opportunities. Several long-term revenue streams have been identified in the Transbay financial plan. These include tax increment funds from the state-owned parcels in the Transbay Redevelopment Project Area and passenger facilities charges ("PFCs") or other commitments from transit operators using the Transit Center. Because the bulk of the revenue from these sources is anticipated after the completion of a portion of the Transbay Program, the financial plan includes a construction period loan. Descriptions of the identified revenue sources are provided in the following section. Table 14 includes a summary of the identified funding for the Transbay Program, each of which is discussed in detail below.

**Table 14. Revenue by Phase as of March 2010**

| | **Identified Revenue** (in $ Millions, YOE) | | |
|---|---|---|---|
| **Source** | **Phase 1 (Transit Center Building & Train Box)** | **Phase 2 (DTX)** | **Total** |
| SF Prop K | 98.2 | 49.0 | 147.2 |
| San Mateo Sales Tax | 4.5 | 24.5 | 29.0 |
| AC Transit Capital Contribution | 38.5 | | 38.5 |
| Lease & Interest Income and TDRs | 6.2 | | 6.2 |
| Other Local | 0.8 | | 0.8 |
| RM 1 | 54.4 | | 54.4 |
| RM 2 | 143.0 | 7.0 | 150.0 |
| AB 1171 | 150.0 | | 150.0 |
| RTIP | 28.3 | | 28.3 |
| Land Sales | 429.0 | 185.0 | 614.0 |
| FTA Section 1601 | 8.8 | | 8.8 |
| SAFETEA-LU Grants | 53.6 | | 53.6 |
| FRA Rail Relocation | 2.65 | | |
| TIFIA Loan Proceeds | 171.0 | 377.4 | 548.4 |
| Recovery Act High Speed Rail | 400.0 | | 400.0 |
| **Total** (may not sum due to rounding) | **1,589.0** | **642.9** | **2,231.9** |

[14] Lease income will be generated from right of way parcels after they are acquired and before they are vacated for construction or staging purposes. This lease income does not include revenues generated from state-owned parcels after they are transferred to the TJPA. Lease income from the state-owned parcels will be deposited in the Public Transportation Account with the State.

The timing of revenues for Phase 1 (Transit Center building, including train box) is based on the construction schedule. Like many other capital projects and programs, the availability of funding is tied closely to the nature and schedule of the Program elements to be constructed. The schedule directly influences the availability of several revenue sources, including land sales, tax increment, and PFCs. The funding plan includes land sales revenues that are contingent upon completion of various components of the Program. When the Transbay Program no longer requires specific parcels (e.g., for construction staging or for the temporary bus terminal), those parcels can be sold and developed. The estimated land sales schedule used to develop the financial plan accounts for the timing and uses of all state-owned parcels. The updated land sales schedule and sales estimates form the bases of a revised tax increment revenue projection.

For the Phase 1 (Transit Center building, including train box) funding plan, only those enacted revenues that would be available during the construction period have been applied to the commitment schedule. Thus, no statewide bond proceeds or other undetermined revenues are included in the Phase 1 funding plan. In addition, only tax increment and AC Transit PFCs have been assumed for the TIFIA loan repayment for Phase 1.

*Local Sources*

**San Francisco Proposition K Sales Tax**. On November 4, 2003, the voters of San Francisco approved Prop K, which imposes a 0.5% sales tax to be used for transportation purposes. The SFCTA is responsible for allocating, administering, and overseeing Prop K funds. The Prop K Expenditure Plan, which provided voters with the list of projects and programs to be funded with the sales taxes, includes $270 million (in 2003 dollars) for the Transbay Program. When developing the Expenditure Plan, the SFCTA did not take into account the cost of advancing sales tax revenues to fund capital projects scheduled early in the tax collection period. In addition, the new Prop K sales tax replaced the existing transportation sales tax, and several large capital projects were grandfathered into the new tax program. Whereas most of the new projects were responsible for the financing costs associated with advancing funds to meet their delivery schedules, the financing costs for the grandfathered projects were distributed among all of the new projects and programs. Thus, when the SFCTA developed its 2005 Strategic Plan, the document that guides revenue allocations, the funding available for the engineering, design, and construction of the Transbay program was reduced to approximately $135 million (in 2003 dollars), or $148 million in YOE dollars. As of March 2010, $147.2 million in Prop K funds have been allocated to the Transbay Program.

**San Mateo Measure A Sales Tax**. The San Mateo County Transportation Authority ("SMCTA") is an independent agency formed to administer the proceeds of a county-wide 0.5% sales tax. Voters approved Measure A, which established the program in June 1988. Measure A sales tax collections began in January of 1989. The tax expired on Dec. 31, 2008. Resolution 3434, the RTEP, includes approximately $29 million (in 2004 dollars) of San Mateo Measure A sales tax funds for the Transbay Program. The financial plan assumes an annual Measure A sales tax growth rate of 3%. As of March 2010, $11.1 million in Measure A funds have been allocated to the Transbay Program. Additional allocations of $11.8 million are pending SMCTA board action.

**AC Transit Capital Contribution**. The AC Transit Lease and Use Agreement outlines AC Transit's bus operations in the Temporary Terminal and the Transit Center through at least the year 2050. In the agreement, AC Transit has committed to contribute $57 million in 2011 dollars to the capital cost of the Transit Center. Although the AC Transit and TJPA have agreed on a schedule of estimated payments of particular amounts, the agreement grants AC Transit flexibility to determine the amount and timing of its capital contribution payments, as long as it pays the capital contribution in full by 2050. AC Transit plans to use grant funds to pay the first $38.5 million of its capital contribution in

lump sums of varying amounts from 2010 to 2014. AC Transit expects to pay the remaining $19 million when it begins bus service in the Transit Center by imposing PFCs on its passengers traveling to and from San Francisco. AC Transit has proposed a PFC of $.25 per trip, to be increased by $.05 every three years, until AC Transit's total capital contribution is paid. If AC Transit is unable to pay the full amount of any estimated lump sum or annual payment, then AC Transit will pay the outstanding balance through collection of PFC revenue after 2032. AC Transit may prepay all or part of its capital contribution, as long as the total payment equals $57 million in 2011 dollars, applying a discount rate of 4.5%.

**Pre-Construction Lease Proceeds**. The TJPA receives lease income from tenants of properties acquired for the Transbay Program. The funding plan includes lease income for the period prior to termination of the leases as a result of the start of construction.

**Transferable Development Rights**. The TJPA's purchase of the 80 Natoma property for right of way preservation included transferable development rights ("TDRs"). The Appraisal of Real Estate defines a transferable development right as "a development right that is separated from a landowner's bundle of rights and transferred, generally by sale, to another landowner in the same or a different area."[15] Buyers of TDRs may use the rights to develop at higher densities than zoning regulations might otherwise allow. Ownership of TDRs is a taxable property interest, and the conveyance of TDRs is a change of ownership requiring reappraisal of this property interest for property tax purposes.[16] The TJPA has sold 160,000 units of TDR equivalent to 160,000 square feet of gross floor area improvements for $4.04 million. These funds will be applied to the Transbay Program costs.

**Interest Income**. The TJPA's investment policy allows the TJPA to invest cash balances in the City and County of San Francisco's City Treasurer's cash and investments pool as well as insured savings or money market accounts. The estimated returns on these investments are included in the Transbay Program financial plan.

**Other Local Sources**. The San Francisco Redevelopment Agency has made an in-kind contribution to the TJPA. This work included the Design for Development preparation for the Transbay Redevelopment Project Area.

***Regional Sources***

**Regional Measure 1**. In November 1988, Bay Area voters approved Regional Measure 1 ("RM 1"), which authorized a standard auto toll of $1 for all seven state-owned Bay Area toll bridges. The additional revenues generated by the toll increase were identified for use for certain highway and bridge improvements, public transit rail extensions, and other projects that reduce congestion in the bridge corridors. Resolution 3434 includes $53 million in RM 1 funds for the Transbay Program. In addition, $1.4 million in RM 1 funds were provided as local matching funds to the TJPA's Federal Section 1601 planning grant. As of March 2010, an additional $5.2 million in RM 1 funds has been allocated to the Transbay Program.

[15] Appraisal Institute. *The Appraisal of Real Estate*. 11th ed. Chicago: Appraisal Institute, 1996. p. 148.
[16] Assessor's Handbook Section 501, Basic Appraisal. California State Board of Equalization. January 2002. p. 26.

**Regional Measure 2**. On March 2, 2004, voters passed RM 2, raising the toll on the seven state-owned toll bridges in the San Francisco Bay Area by $1.00. This extra dollar funds various transportation projects within the region that have been determined to reduce congestion or to make improvements to travel in the toll bridge corridors, as identified in SB 916.[17] Specifically, RM 2 establishes the Regional Traffic Relief Plan and identifies specific transit operating assistance and capital projects and programs eligible to receive RM 2 funding. The Transbay Program is eligible for $150 million in RM 2 capital funds, and $3 million per year (escalated by 3.5% per year, starting in July 2004) of RM 2 operating funds for the operation and maintenance of the Transit Center. As of March 2010, all $150 million in RM 2 funds has been allocated to the Transbay Program.

**AB 1171**. MTC's Resolution 3434 includes $150 million in AB 1171 funds for the Transbay Program. This source results from the adoption of AB 1171 by the California legislature for a plan to fund the cost of seismic retrofit of Bay Area toll bridges. The Transbay Program is eligible for these funds under a provision that makes the money available to projects consistent with the purposes of the voter-approved RM 1 program. As of March 2010, $15.9 million has been allocated to the Transbay Program.

*State Sources*

**Regional Transportation Improvement Program**. The State Transportation Improvement Program ("STIP") is the State's spending plan for state and federal funding. The STIP is comprised of the Regional Transportation Improvement Program ("RTIP") and the Interregional Transportation Improvement Program ("ITIP"). MTC and the SFCTA, acting as the San Francisco Congestion Management Agency, program Regional Improvement Program funds for inclusion in the RTIP. RTIP funds for the Transbay Program are planned to come from the Public Transportation Account, and are subject to fluctuations in the state budget and the condition of the economy. The STIP is updated every two years and currently covers a five-year period. The 2004 update to MTC's Resolution 3434 includes $24 million (in 2004 dollars) for the Transbay Program. The financial plan assumes an annual RTIP growth rate of 3%. SFCTA's Resolution 06-30, approved in November 2005, limits programming of all San Francisco RTIP capital funds to four major capital projects, including the Transbay Program, until the RTIP commitments to those four projects under Resolution 3434 are fulfilled. As of March 2010, $7.391 million in RTIP funds have been allocated to the Transbay Program.

**Land Sales**. The 1998 Loma Prieta earthquake resulted in the demolition of several elevated freeway structures in the vicinity of the Transbay Terminal. In a cooperative agreement signed in July 2003, the State of California agreed to transfer approximately 12 acres of this state-owned land for the benefit of the Transbay Program. In December 2007, the California Transportation Commission ("CTC") authorized the transfer of the parcels, the final step in conveying the land for the Transbay Program. The cooperative agreement limits the use of the land sales revenues to construction costs. This limitation has been incorporated into the financial plan. The uses for each parcel have been described in the Transbay Redevelopment Project Area Design for Development. Based on the Transit Center building construction schedule, the Program Management/Program Controls consultant developed an estimate of when each of the parcels would be available for sale. The land use information and sale schedule form the basis for the land sales revenue estimates prepared by The Concord Group. The Concord Group estimate was prepared in 2007, and will be updated in 2010 and throughout the life of the Program. The financial plan assumes an annual growth rate of 2% for land values.

[17] Chapter 715, Statutes of 2004.

*Federal Sources*

**Section 1601 Grant**. The Transbay Program received a commitment of $8.8 million under Section 1601 of the Transportation Equity Act for the 21st Century ("TEA-21"). The federal funds have been matched by approximately $800,000 in RM 2 bridge tolls and $1.4 million in RM 1 bridge tolls. The TJPA has used these funds for planning, environmental, and preliminary engineering work.

**High Priority Bus**. The federal transportation reauthorization bill, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users ("SAFETEA-LU"), includes two commitments of Section 5309 Bus and Bus-Related Facilities funds for the Transbay Program totaling $29.2 million. The Bus and Bus-Related Facilities program provides capital assistance for new and replacement buses and related equipment and facilities. As of March 2010, after the federal rescissions, which are calculated during the annual appropriations process, all $29.1 million has been awarded to the Transbay Program.

**Projects of National and Regional Significance**. The Projects of National and Regional Significance ("PNRS") program provides funding for high cost projects of national or regional importance. SAFETEA-LU includes a commitment of $27 million for the Transbay Program under PNRS. As of March 2010, after the federal rescissions, which are calculated during the annual appropriations process, all $24.5 million has been awarded to the Transbay Program.

**Federal Railroad Administration Rail Relocation**. The Program for Capital Grants for Rail Line Relocation and Improvement Projects funds construction projects that improve the route or structure of a rail line and involves a lateral or vertical relocation of any portion of the rail line, or are carried out for the purpose of mitigating the adverse effects of rail traffic on safety, motor vehicle traffic flow, community quality of life, or economic development. The TJPA has received two commitments totaling $2.65 million under this program.

**TIFIA Loan**. The financial plan includes a loan from the Department of Transportation under the Transportation Infrastructure Finance and Innovation Act ("TIFIA") of 1998, which provides secured loans, loan guarantees, and standby lines of credit for surface transportation projects of national or regional significance. This program may provide credit support to large transportation projects for up to 33% of a project's eligible cost. Sources for repayment of the TIFIA loan include tax increment from state-owned parcels and PFCs. After an exhaustive review of the Phase 1 funding plan and credit analysis by Fitch Ratings, the TJPA's $171 million TIFIA loan closed on January 25, 2010.

**Recovery Act High Speed and Intercity Passenger Rail**. On February 17, 2009, President Obama signed into law the American Recovery and Reinvestment Act ("Recovery Act"). The Recovery Act appropriated $8 billion nationally for high-speed rail and intercity rail grants to be administered by the FRA. The TJPA applied for $400 million in high-speed and intercity passenger rail funds for the train box. On January 28, 2010, Transportation Secretary LaHood announced his intent to allocate $400 million for the train box in the Transit Center. In a March 29, 2010, letter to the TJPA, USDOT confirmed that it has reserved $400 million within the overall California allocation of the Department's High Speed Rail grants to provide funding for the train box (Exhibit 6b). Since that time, the TJPA has been working with the FRA to develop a grant agreement.

### 4. Level of Detail, Certainty, and Revenue Commitments

Large capital projects are developed in several distinct design stages, with increasing levels of detail produced in each stage. The greater the level of detail, the more certain the program costs. Typically, the level of certainty in the Transbay Program's financial plan increases along with the level of certainty in the design stages. Although the Transbay Program is not participating in the FTA Section 5309 New Starts process, the FTA method for evaluating financial feasibility can be applied to other large capital projects such as this, in order to assess the relative stability and reliability of the capital funding sources. Using the FTA method for determining the status of revenue commitments, the Transbay Program financial plan has a high level of certainty. As shown in Table 15, approximately 22% of the identified funding for Phase 1 (Transit Center building, including train box) has been received, and 78% is committed. As funding commitments occur periodically, the information in the tables is accurate as of the publication of this report in April 2010.

For the Phase 1 (Transit Center building, including train box) funding plan, 100% of the revenue has been received or requested, or is committed. According to the FTA's New Starts evaluation procedures, the level of commitment for the TJPA's financial plan for Phase 1 would receive a "high" rating, the best possible score, for having "100% of Non-Section 5309 New Starts Funds... committed or budgeted."[18]

[18] FTA, Office of Planning and Environment, "Guidelines and Standards for Assessing Local Financial Commitment," June 2007, p. 8.

**Table 15. Phase 1 (Transit Center Building and Train box) Revenue Commitment Status (as of March 2010)**

| Sources for Phase 1 Capital Costs | Source | Amount Available for Phase 1 (in $ Millions, YOE) | Percent Received | Percent Requested | Percent Committed | Percent Budgeted |
|---|---|---|---|---|---|---|
| TIFIA Loan | Federal | 171.00 | | | 100% | |
| SF Prop K Sales Tax * | Local | 98.15 | 100% | | | |
| San Mateo Sales Tax * | Local | 4.50 | 100% | | | |
| AC Transit Capital Contribution | Local | 38.55 | | | 100% | |
| Pre-Construction Lease Proceeds & Interest Income | Local | 2.17 | 100% | | | |
| Transferable Development Rights | Local | 4.04 | 100% | | | |
| Other Local | Local | 0.80 | 100% | | | |
| Regional Measure 1 * | Regional | 54.40 | 12% | | 88% | |
| Regional Measure 2 * | Regional | 143.02 | 100% | | | |
| AB 1171 * | Regional | 150.00 | 11% | | 89% | |
| Regional Transportation Improvement Program * | State | 28.34 | 26% | | 74% | |
| Land Sales ** | State | 429.00 | | | 100% | |
| Section 1601 Grant | Federal | 8.80 | 100% | | | |
| High Priority Bus | Federal | 29.14 | 100% | | | |
| FRA Rail Relocation | Federal | 2.65 | | | 100% | |
| Projects of National and Regional Significance | Federal | 24.46 | 100% | | | |
| Recovery Act High Speed Rail | Federal | 400.00 | | | 100% | |
| **Total/Weighted Average** | | **1,589.00** | **22%** | | **78%** | |

Notes: * 100% committed in Resolution 3434, MTC's Regional Transit Expansion Policy.

** CTC has committed to transfer land; land sales value is estimated as transactions have not been finalized.

*Received:* Funds have been allocated to the TJPA by the funding agency.

*Requested:* TJPA has applied for allocations from the funding agency.

*Committed*: Programmed funds that have all the necessary legislative or referendum approvals. Funds included in Resolution 3434, RTEP, are considered to be committed, but may require board level approval of allocation requests.

*Budgeted*: Funds have been budgeted or programmed for the project but remain uncommitted, i.e., the funds have not yet received statutory approval.

### 5. Sources for Debt Service/Loan Repayment

Table 16 summarizes the revenues that would be used to fund a construction period loan. Table 17 provides information about when the various revenue sources are assumed to be available and whether or not the source escalates over time.

**Table 16. Identified Sources for Debt Service/Loan Repayment for Phase 1 (Transit Center Building and Train Box) Construction Period Loan (as of October 2008)**

| Sources for Debt Service/ Loan Repayment | Component | Amount (in $ Millions, YOE) | Percent Committed |
|---|---|---|---|
| Tax Increment | Transit Center Building & Train Box | 1,447.2 | 100% |
| PFC – AC Transit | Transit Center Building & Train Box | 35.4 | 100% |
| **Total** | | **1,482.6** | **100%** |

Notes: *Committed*: Programmed funds that have all the necessary legislative or referendum approvals.

*Budgeted*: Funds have been budgeted or programmed for the project but remain uncommitted, i.e., the funds have not yet received statutory approval.

*Planned*: Funds that are identified and have a reasonable chance of being committed, but are neither committed nor budgeted.

**Table 17. Estimated Availability for Identified Revenue Sources for Debt Service (as of October 2008)**

| Sources | Years Available | Escalation |
|---|---|---|
| Tax Increment | FY 2011 – 2049 (Phase 1 Transit Center Building & Train Box) | Yes |
| Passenger Facility Charges – AC Transit | FY 2015 – 2050 (Phase 1 Transit Center Building & Train Box*) | Yes |
| Passenger Facility Charges – Caltrain | FY 2020 – 2049 (Phase 2 DTX) | Yes |

Notes: * Up to a present value of $18.5 million in FY2011 dollars using a 4.5% discount rate.

The following section describes each revenue source available for loan repayment.

**Tax Increment.** Tax increment is the increase in tax revenue generated by any increases in property value as assessed after the base year because of change of ownership, improvements or new construction within the Transbay Redevelopment Project Area. The base year for the Transbay Redevelopment Project Area is 2005. The tax increment (net of the housing set-aside fund, pass through payments and other obligations) generated by the state-owned parcels will be dedicated to the Transbay Program. Because the state-owned parcels are currently zoned as public uses, the base assessed value of this land is $0. Annual estimates of tax increment revenue have been developed based on the land sales valuation and market absorption schedule. The financial plan assumes that tax increment revenues will be pledged for the repayment of the debt service for a construction loan. The components of the estimated tax increment growth include general inflation capped at 2% per year, the statutory maximum rate, and no annual increases in reassessments through fiscal year 2018, with a 0.5% per year reassessment increase thereafter.

**Passenger Facility Charges—AC Transit.** A terminal use fee for each major transit operator using the Transit Center building is included in the financial plan. AC Transit and TJPA have agreed to a

payment plan, included in the Lease and Use Agreement. The agreement allows AC Transit to meet its capital obligation through the payment of up-front capital contributions, through annual payments of PFCs, or through a combination of up-front and annual contributions. The total obligation is $57 million in 2011 dollars. For financial planning purposes and as contemplated in the agreement, this contribution has been calculated as a terminal use fee or PFC. AC Transit has proposed a PFC of $.25 per trip, to be increased by $.05 every three years, until AC Transit's total capital contribution is paid. The PFC has been included in the ridership model conducted for the 2004 EIS. In November 2007, Cambridge Systematics, Inc., updated the regional transit ridership model to better estimate future bus ridership to the Transit Center. The financial plan assumes that PFC or other revenues would be collected by AC Transit when the Transit Center opens. This revenue stream will be used to partially repay the debt service for a construction loan for Phase 1.

**Passenger Facility Charges—Caltrain.** As with AC Transit, the financial plan includes a contribution from Caltrain calculated as a fee assessed to each passenger using the Transit Center building. This revenue source requires a commitment by the Caltrain board of directors. The calculation is based on a per Caltrain passenger fee of $.75 in fiscal year 2001 dollars; the financial plan assumes the PFCs would escalate at 3% per year. The PFC has been included in the ridership modeling exercise conducted for the 2004 EIS. The financial plan assumes that PFC or other revenues would be used to partially repay the debt service for a construction loan for Phase 2, the DTX.

### 6. Contingencies/Funding Shortfalls

The TJPA continues to seek cost savings and new revenue sources for both phases of the Transbay Program. New sources or increased revenues that could be realized after the construction of Phase 1 would be applied to Phase 2.

Some of the options currently under consideration include the following:

- federal Stimulus Recovery Act grants, including Urban Circulator funds;
- statewide bond proceeds, including Prop 1B (Highway Safety, Traffic Reduction, Air Quality, and Port Security), Prop 1C (Housing and Emergency Shelter Trust Fund), and High Speed Rail bonds;
- real estate-based revenues including Mello-Roos District fees or transportation impact fees;
- advancing land sales revenues from Phase 2 (DTX) to Phase 1 (Transit Center building, including train box);
- revenue sharing with Caltrain from projected ridership increases;
- advocacy for new regional and statewide revenue sources through MTC's Resolution 3434, such as bridge toll revenues, regional gas taxes, state revenue restructuring and potential increases, VMT pricing, and congestion pricing;
- funds from federal transportation bill reauthorization;
- private partnerships including options such as naming rights and annuities;
- further phasing of Transbay Program to advance Phase 2 (DTX) elements to reduce impacts of cost escalation;
- Federal Passenger Rail Investment and Improvement Act grants; and
- California Prop 1A high-speed rail bonds.

The TJPA will continue to seek new funding, secure identified sources, and reduce Program costs throughout the planning process.

## E. Operating Plan

### 1. Transit Center Operating and Maintenance Plan

The new Transit Center would feature a number of design elements to reduce maintenance requirements and operating costs. For example, the new Transit Center will take advantage of natural daylight to offset the need for electric lighting during daylight hours while light columns will bring natural light into the internal areas of the station.

In September 2008, the TJPA and AC Transit entered into a Lease and Use Agreement for the Transit Center. At the time of the agreement, the estimated annual operating and maintenance costs for the Transit Center were approximately $6 million (in 2007 dollars). Updates to the cost estimates are on-going.

The TJPA has identified several sources of revenue to fund the Transit Center operations and maintenance costs. Ongoing revenues are anticipated from commercial leases in the Transit Center. The TJPA is working with retail consultants to determine an appropriate mix of retail that is viable, contributes to operational revenues, and effectively co-exists with transit operations. RM 2 includes a commitment of $3 million per year (escalated at 3.5% per year, starting on July 1, 2004) of bridge toll funds to be used as operating and maintenance assistance for the new facility. Under the terms of the Lease and Use Agreement, transit operators (tenants) will be responsible to fund the net operating and maintenance costs.

### 2. Transit Service Providers Operating and Maintenance

Bus and rail transit service operating costs and revenues are not included in the Transbay financial plan. Individual operators using the Transit Center will continue to have jurisdiction over their operations and maintenance programs and revenues. However, this section provides a brief overview of the anticipated changes to operating costs attributable to the Transbay Program.

It is anticipated that changes to AC Transit's operating costs (aside from the lease payments due under the Lease and Use Agreement) will be negligible, as the new Transit Center bus station will be built on the same site as the current Transbay Terminal.

As stated in the 2004 EIS, moving the Caltrain terminal from Fourth and King streets to the Transit Center, a distance of 1.3 miles, would have a modest effect on the total annual operating costs of Caltrain service. The projected increase in train operating costs is expected to be funded by fare revenues from increased Caltrain ridership.

The 2008 Bay Area to Central Valley EIR/EIS reports that "the 4th and King terminal station would attract about 1 million fewer annual passengers (about 3%) than the Transit Center (including long-distance commuter passengers) and would have $19 million less revenue (0.6% less)."[19] Thus, HST service along the DTX alignment from Fourth and King to the Transit Center would generate $19 million in annual revenue. The incremental cost of operations is anticipated to be significantly less than $19 million per year.

[19] California High Speed Rail Authority, *2008 Bay Area to Central Valley EIR/EIS*, page 7-141.

## V. FRA AS A SIGNATORY TO SECTION 106 MOA

Federal Railroad Administration ("FRA") intends to become a signatory to the Section 106 Memorandum of Agreement between the Federal Transit Administration and the California State Historic Preservation Officer Regarding the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project in San Francisco County, California ("MOA"). On March 30, 2010, a letter of formal notice of FRA's request to be added as a signatory was sent by the Transbay Joint Powers Authority ("TJPA") to the State Historic Preservation Officer ("SHPO"). An amendment to the MOA adding FRA as a signatory will be developed with the signatories to the MOA (SHPO and Federal Transit Administration).

## VI. CONCLUSION

This Reevaluation considers the previously conducted environmental review for the Transbay Transit Center train box, and concludes that there have been no changes to the proposed action that would result in significant environmental impacts that were not previously evaluated in the 2004 EIS, and no new information or circumstances relevant to environmental concerns and bearing on the proposed action or its impacts that would result in significant environmental impacts not previously evaluated in the 2004 EIS. Based on this conclusion, and because the Transbay Program as described in the 2004 EIS, including the mitigation measures identified therein, satisfied the requirements of NEPA, and the actions covered by the 2004 EIS and the proposed action are substantially the same, it is appropriate for the FRA to adopt the 2004 EIS as updated by this Reevaluation.

Exhibit 1

# Addendum for the Transbay Terminal/Downtown Extension/Redevelopment Project

# Final Environmental Impact Statement/Report

May 25, 2006

Transbay Transit Center

URS

In association with
Hatch Mott MacDonald & EPC Consultants
Consultants to the Transbay Joint Powers Authority

Preparation of this report was made possible in part by the Metropolitan Transportation Commission through a grant of Regional Measure 2 (RM2) funds.

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# TRANSBAY TRANSIT CENTER PROGRAM

## Addendum for the

## Transbay Terminal/Downtown Extension/Redevelopment Project

## Final Environmental Impact Statement/Report

## May 25, 2006

## Prepared for the

## Transbay Joint Powers Authority

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**APPENDIX**

**Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project EIS/EIR Transportation Assessment of Change to Traffic Flow associated with the proposed Refined Locally Preferred Alternative, Technical Memorandum, Luba C. Wyznyckyj, February 22, 2006**

# 1 INTRODUCTION

This addendum to the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project Final Environmental Impact Statement/ Environmental Impact Report (Final EIS/EIR) (SCH #95063004), which was certified in April 2004 and was reaffirmed by the Board of Supervisors on June 15, 2004, has been prepared pursuant to Section 15164 of the California Environmental Quality Act (CEQA) guidelines. The addendum provides an analysis of the environmental impacts that may result from proposed changes to the approved Locally Preferred Alternative (LPA) described and analyzed in the Final EIS/EIR. Each topical area previously examined in the Final EIS/EIR is reviewed and analyzed below with regard to proposed changes to the Transbay Transit Center (TC) Building design and reconstruction. The proposed changes, which are refinements to the LPA (herein identified as the Refined Project), are described in the following subsection.

This addendum addresses the question of whether the proposed changes to the Project would trigger the need for subsequent environmental review pursuant to Public Resources Code 21166 and Section 15162(a) of the CEQA guidelines. The Final EIS/EIR evaluated the following natural resources and urban systems: Land Use/Wind/Shadow, Displacements and Relocations, Socio-economics, Community Facilities and Services/Safety and Security, Parklands/Schools/Religious Institutions, Air Quality, Noise and Vibration, Geology and Seismology, Water Resources and Floodplains, Utilities, Historic and Cultural Resources, Hazardous Materials, Visual and Aesthetics, Transit/Traffic/Parking, and Construction Methods and Impacts. Analysis of cumulative impacts is interwoven in the discussion provided for each topic area. An analysis of each of these topics for the Refined Project is provided below under the Evaluation of Environmental Impacts subsection.

# 2 DESCRIPTION OF REFINED PROJECT

The Transbay Transit Center (TC) Building component of the LPA consists of a new, multi-modal transit center.[1] The Refined Project consists of the following changes to the conceptual design and construction for the TC Building component of the LPA:

- Reduction in the building height and size;
- Consolidation of bus operations on the AC Transit level;
- Relocating Greyhound operations to the Train Mezzanine level;
- Elimination of one level of bus ramp;
- Improvements in public access and pedestrian circulation at the Ground level;
- Two-phase (Phase 1 and Phase 2) construction process;
- Use of a temporary Greyhound boarding area prior to construction of the permanent boarding facility in Phase 2; and
- Use of a reduced number of piles (caissons) for construction of the Transbay Transit Center Building.

[1] A more detailed description of the Refined Project is provided in the Recommended Program Implementation Strategy, Transbay Joint Powers Authority, February 10, 2006, and the Final Massing Study for the Transit Center Building, Transbay Joint Powers Authority, February 16, 2006.

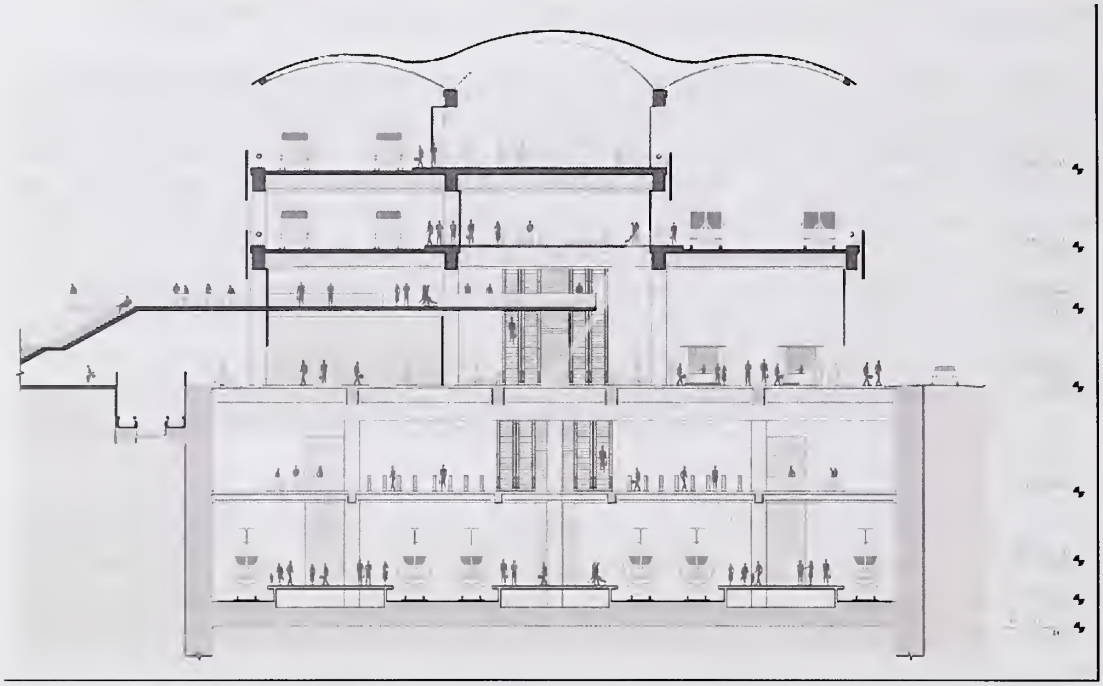
## 2.1 Modifications to the Transbay Transit Center Building and Bus Ramp Design

The Transbay Transit Center (TTC) Building would retain the footprint established in the Final EIS/EIR – extending from the west side of Beale Street across Fremont and First Streets to and including the parcels acquired by the Transbay Joint Powers Board (TJPA) at 80 Natoma – but would be reduced in height and size. The reduction in height would be accomplished by removing the top bus level originally planned to serve Greyhound and other miscellaneous bus carriers (Figure 2.1). The specific reduction in the 109-foot roof height and approximately 156 feet to the top of the cone-shaped roof elements presented in the Final EIS/EIR would be determined in final design. Although the TC Building would be extended 100 lineal feet on the west end from what was proposed in the Final EIS/EIR, the total square footage contained within the TC Building would be reduced from approximately 1.1 million gross square feet to approximately 1.0 million gross square feet because of reductions in floor space on the Concourse and Ground level as described below.

The AC Transit (AC) level would then become the building's top level, which would be reduced in width from 165 feet to 155 feet, but would maintain the same number of bus bays and circulation pattern planned as part of the LPA. By eliminating one bus level, the bus ramp linking the TC Building with I-80 (Bay Bridge) could be confined to a single-level structure replacing the two-level, stacked ramp concept described for the LPA. The single-level ramp would be approximately 40 feet above street level and approximately 20 feet lower than the top of the stacked ramp. The suburban and charter bus operations displaced from the upper level would be relocated on the AC level. Greyhound would move to a permanent boarding area on the Train Mezzanine level when the passenger train station is completed in Phase 2.

Located directly below the AC level, the Concourse level would be reduced in area from that described for the LPA. The Refined Project would concentrate retail uses in the central portion of the building above the main public lobby and at the west end of the TC Building on the Ground level and on the Concourse level, creating two-level retail spaces. The reduction in retail space on the Concourse level would allow a more spacious lobby and improved circulation between the Ground level and the Concourse (Figure 2.1).

The Concourse level and Ground level would be reduced in width from 165 feet to approximately 110 feet, allowing adjacent public sidewalks to be widened and more sunlight to penetrate into the center of the TC Building. The actual widths will be established during final design. Space resulting from the redesigned Concourse and Ground levels would be allotted for office lease space, flexible support space, and community use space. In addition, the Ground level would be redesigned to take advantage of the enlarged lobby and expanded exterior sidewalks created by cantilevering the AC level over the main public entryway for the TC Building. Pedestrian access to and from the north side of the Ground level would be from a redesigned public plaza or enclosed winter garden space facing Mission Street. The south side of the Ground level (along Natoma Street) would be configured to accommodate taxi and paratransit drop-offs and pick-ups and to improve pedestrian access to and from the TC Building. A second public lobby area is located on the western side of the TC Building between Minna and Natoma Streets with entrances from First Street. An additional public access point would be provided from the Bus Plaza between Beale and Fremont Streets.



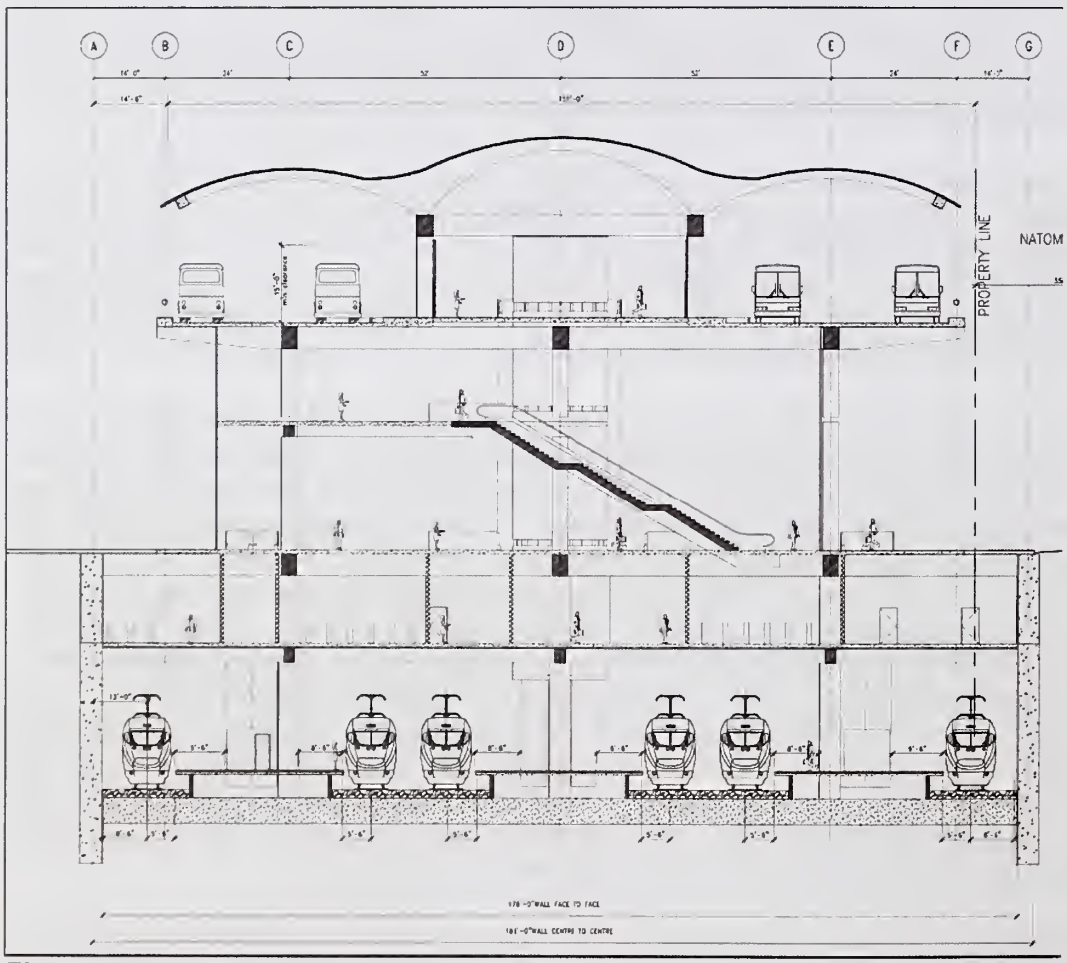



**Figure 2.1, Refined LPA**

### 2.1.1 Phased Construction and Refined Construction Methods

All components of the LPA were to be constructed simultaneously in one phase. In the Refined Project, construction activities would be accomplished in two phases. Phase 1 would complete the above-grade (bus operations) portion of the TC Building and provide the structural supports, including drilled caissons and permanent perimeter shoring walls, to allow excavation and completion of the underground train station and mezzanine level in Phase 2 (Figure 2.2, Figure 2.3) Approximately 125 caissons would be used to support the above-grade TC Building, substituting for the nearly 1,000 piers assumed in the original (LPA) construction procedures. In addition, structural steel would replace concrete as the main support element to lighten the structure and to reduce costs.

### 2.1.2 Temporary Terminal

As described in the Final EIS/EIR (pg. 5-184), the LPA would require construction of a Temporary Terminal that would be used by bus operators during construction of the new Transbay Transit Center. The Temporary Terminal is proposed to be located on two blocks. Under the LPA, the core of the Temporary Terminal would be constructed on the block defined by Main/Beale/Folsom/Howard Streets and would serve primarily AC Transit operations. The curbside areas would serve Muni, Samtrans, and Golden Gate Transit. Greyhound passengers would board and alight at an adjacent terminal across Beale Street between Folsom and Howard Streets. Under the Refined Project, the Temporary Terminal would be used during Phase 1 construction and may be continued for use by Greyhound if Option 2, described below, were selected as the Greyhound interim boarding area prior to Phase 2 construction.

### 2.1.3 Greyhound Temporary and Permanent Boarding Areas

The two-phase construction schedule would delay Greyhound's move to a permanent boarding area on the Train Mezzanine level until Phase 2 construction is completed. The Refined Project would, therefore, require Greyhound to operate at an interim boarding location until Phase 2 is finished. Three temporary locations are being considered for the Greyhound interim boarding location: 1) the AC level of the Terminal; 2) the Temporary Terminal; or 3) the western end of the TC Building on the Ground level. These options are described below.

#### 2.1.3.1 Option 1: Temporarily Relocating Greyhound to the AC Level

Relocating Greyhound operations to the AC Transit level in Phase 1 is the preferred option if sufficient capacity is available to accommodate AC Transit, Greyhound, and other bus operators using the Transbay Transit Center. An operational and capacity analysis will be conducted to confirm this assumption. Access to and from the TC Building would still be via the bus ramp connecting with I-80 or through bus storage link ramps linking the TC Building with the bus storage area at Third Street and Stillman Street, as described in the Final EIS/EIR.

#### 2.1.3.2 Option 2: Remaining for an Extended Period at the Temporary Terminal until Phase 2 is Complete.

Greyhound operations at the Temporary Terminal could be located on the block bounded by Folsom, Beale and Fremont Streets, as described in the Final EIS/EIR (pg. 5-184), and would remain there until Greyhound's permanent boarding area in the Terminal Train Mezzanine level is finished. Alternatively, Greyhound could be temporarily located on the block bounded by

Folsom, Main, Beale and Howard Streets where AC Transit and other bus carriers would operate until Phase 1 is completed (Figure 2.4 illustrates these alternative locations). A customer waiting and ticket area would be constructed for Greyhound in the center of the block. This structure would either be torn down when Greyhound moves to its permanent boarding area within the TC Building or reused as a park pavilion for the planned park in the middle of this block. To make room for Greyhound operations on this block, some AC Transit buses would move across the street to the block bounded by Folsom, Beale and Fremont Streets.

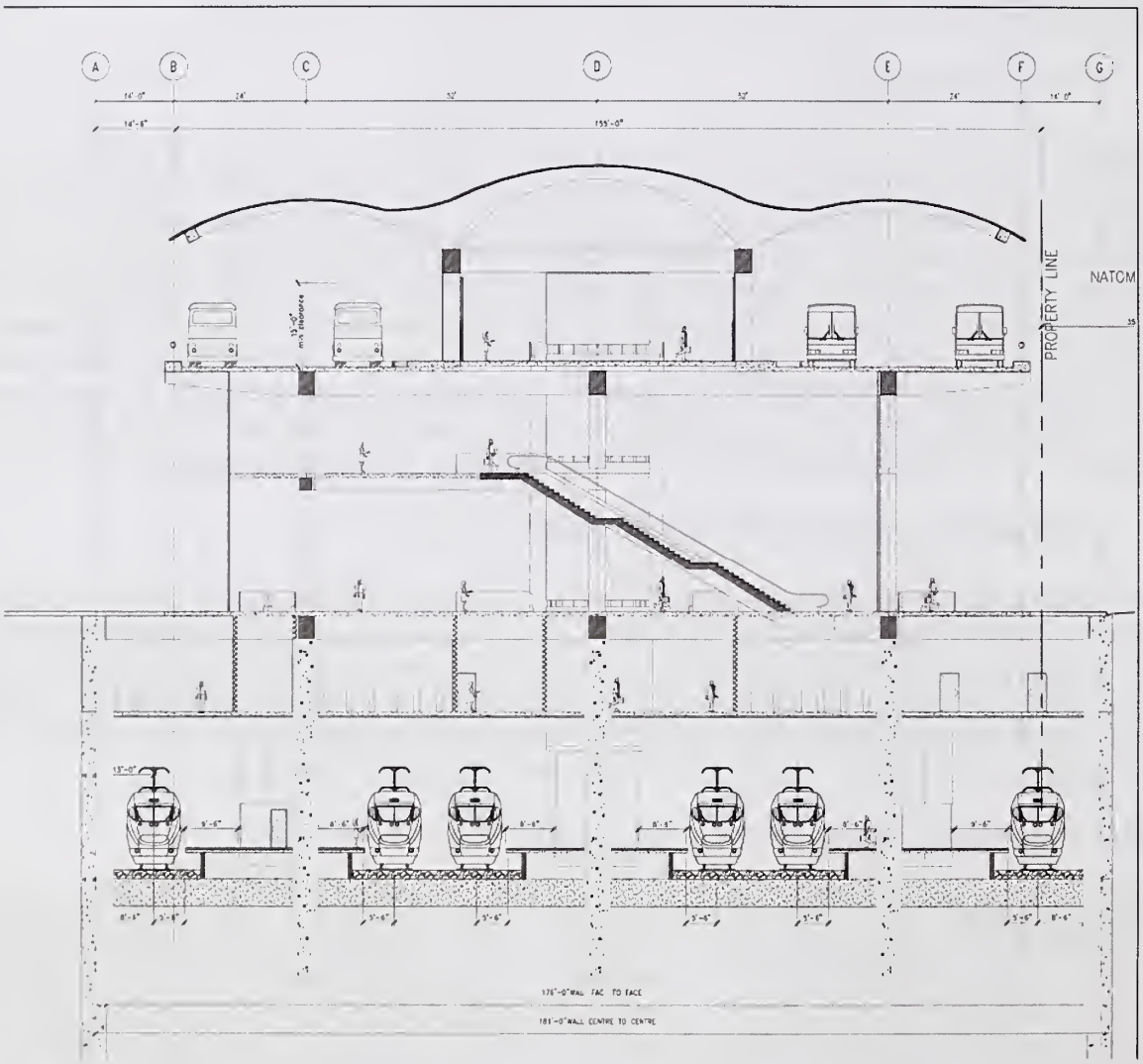



**Figure 2.2, Phase 1 – Above-Grade Building**

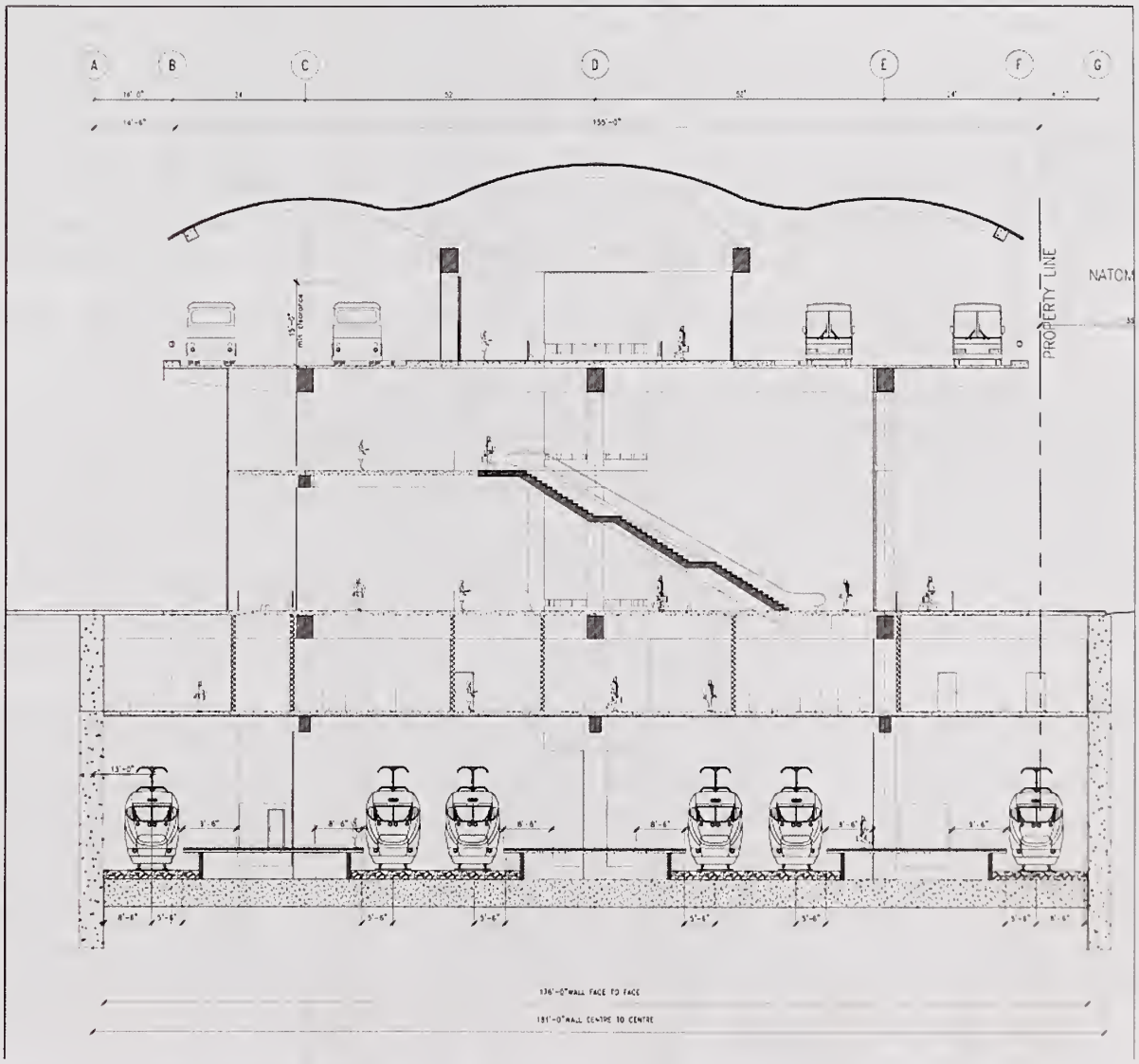



**Figure 2.3, Phase 2 - Excavated Train Station**

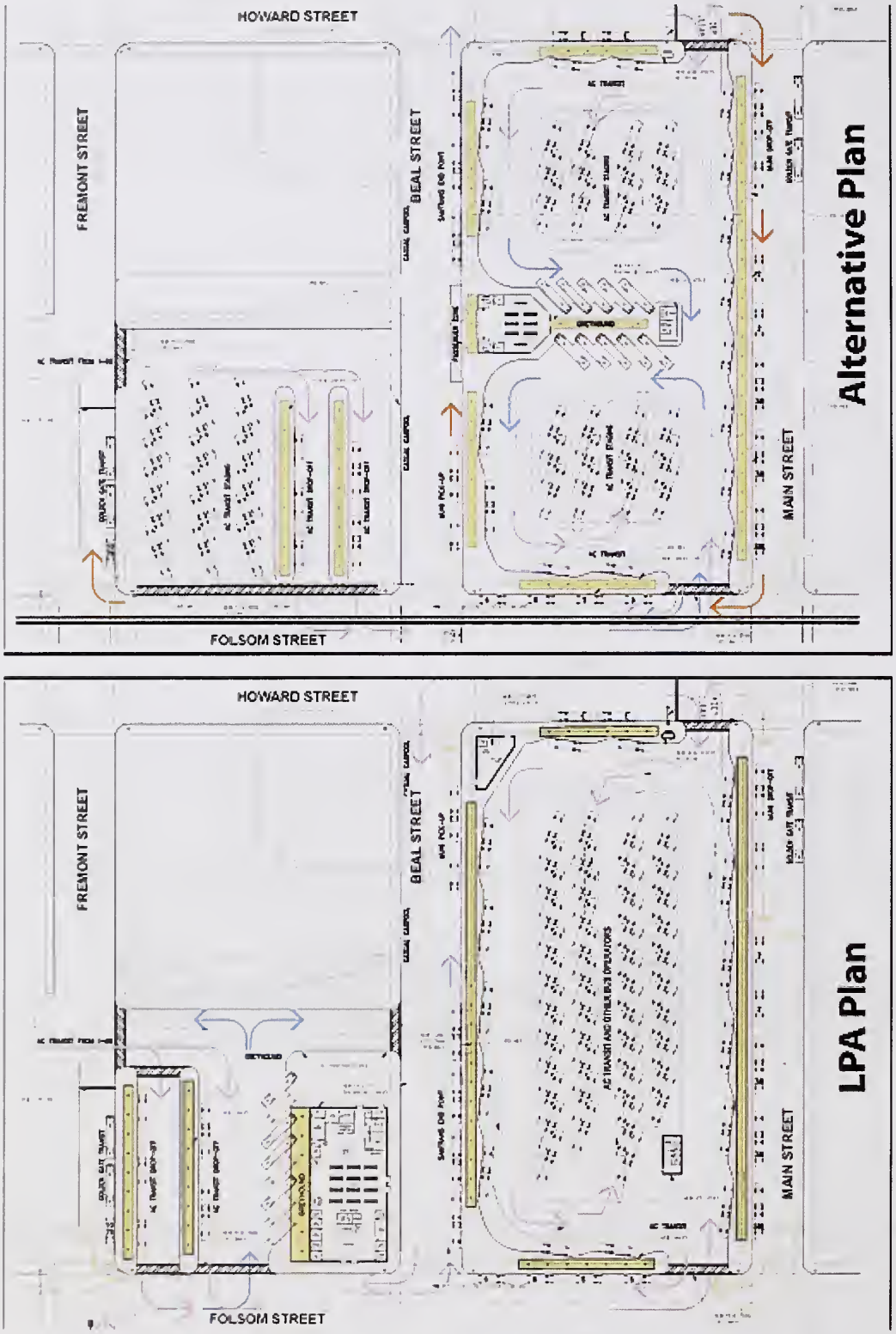



**Figure 2.4, Greyhound at the Temporary Terminal - Interim Location**

In Option 2, buses traveling from the I-80 off-ramp at Fremont Street could either enter the two blocks of the Temporary Terminal from Folsom Street or enter the block between Fremont and Beale Streets directly from the Fremont Street off-ramp by crossing Fremont Street at the foot of the ramp (Figure 2.4, Greyhound at the Temporary Terminal – Interim Location: LPA PLAN). Northbound through-traffic on Fremont Street would be controlled by a stoplight or stop sign at the foot of the Fremont Street off-ramp to ensure safe movement of buses into the Temporary Terminal. As indicated in Figure 2.4, Greyhound at the Temporary Terminal – Interim Location: Alternative Plan, the street segments of Beale Street between Folsom and Howard Streets, and Main Street between Folsom and Howard Streets, would be converted to two-way traffic operation to allow bus loading zones and curbside public access at the Temporary Terminal. The contra-flow bus-only lane established on Folsom Street extending from Main Street to Essex Street and passing adjacent to the Temporary Terminal would remain as described in the LPA. These elements of the project design would allow bus circulation and bus stops to be placed on all four sides of the Temporary Terminal. Circulation patterns established for the Temporary Terminal would be modified for two-way operation consistent with Design for Development guidelines in the Transbay Redevelopment Plan.

#### 2.1.3.3 Option 3: Temporarily Relocating Greyhound to the Western End of the Transit Center on the Ground Level.

Relocating Greyhound operations to the western end of the Terminal at street level would require creation of a dedicated boarding area on Natoma Street as indicated in Figure 2.5. Natoma Street operates as a one-way eastbound alley. Buses would enter Natoma Street from westbound Howard Street via a new driveway, and would leave Natoma Street and enter First Street southbound at a signal-free intersection. In this option, buses would travel to the I-80 on-ramp via First Street and from the I-80 off-ramp via Fremont and Howard Streets. Selection of Option 3 would require that proposed Ground level retail and pedestrian sidewalk improvements at the western end of the TC Building would be deferred until Phase 2.

After Phase 2 construction is completed, Greyhound would relocate to a permanent boarding area on the Train Mezzanine level of the TC Building. A two-way bus driveway ramp would be constructed on Howard Street 250 feet east of the intersection with Second Street to allow Greyhound buses to enter the underground boarding area (Figure 2.6). The two-way ramp, used exclusively by Greyhound, would be aligned directly below or adjacent to the overhead bus ramp that provides access at the AC Transit level, passing under Natoma Street before entering the TC Building. Greyhound customer service, public waiting and ticketing area would be located on the Ground level, one level above the boarding area. Stairs, escalators, and an elevator would provide access from the Ground level waiting area to the Greyhound boarding area below.

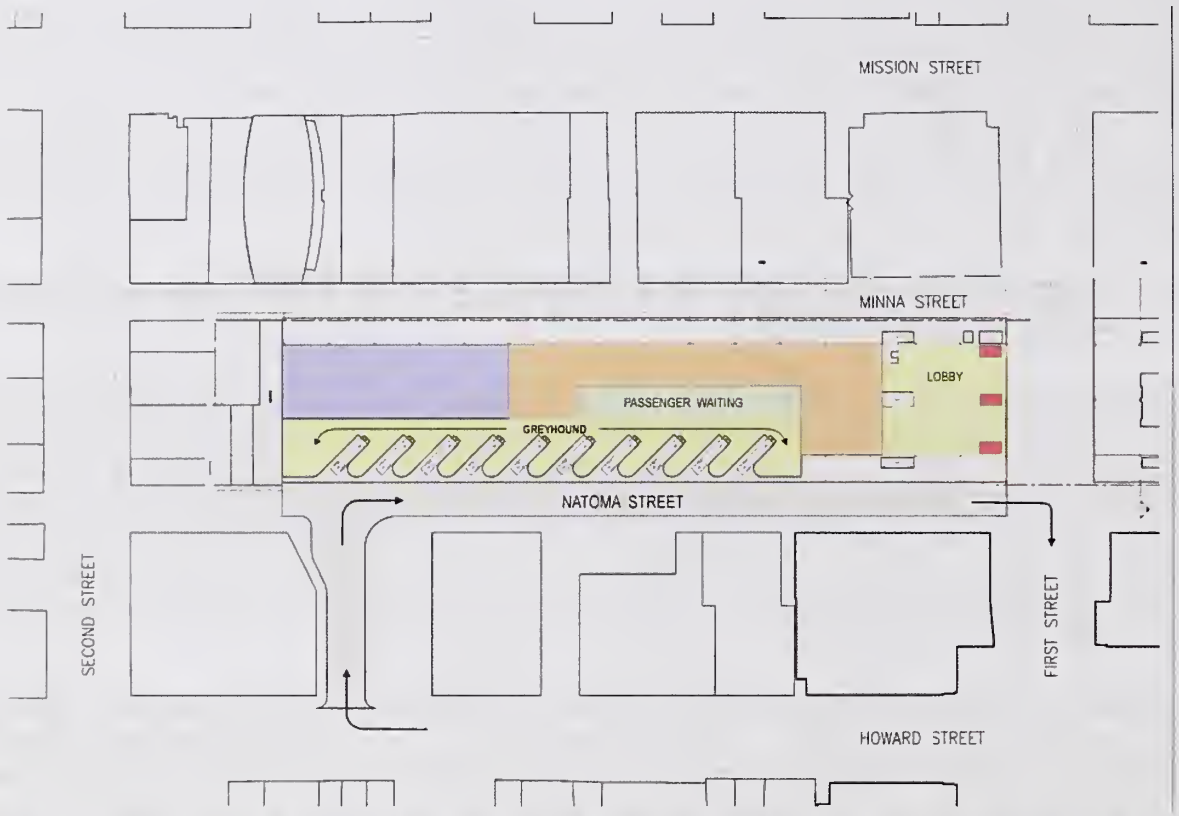



**Figure 2.5, Greyhound at the West End of the Transit Center Building- Interim Location**

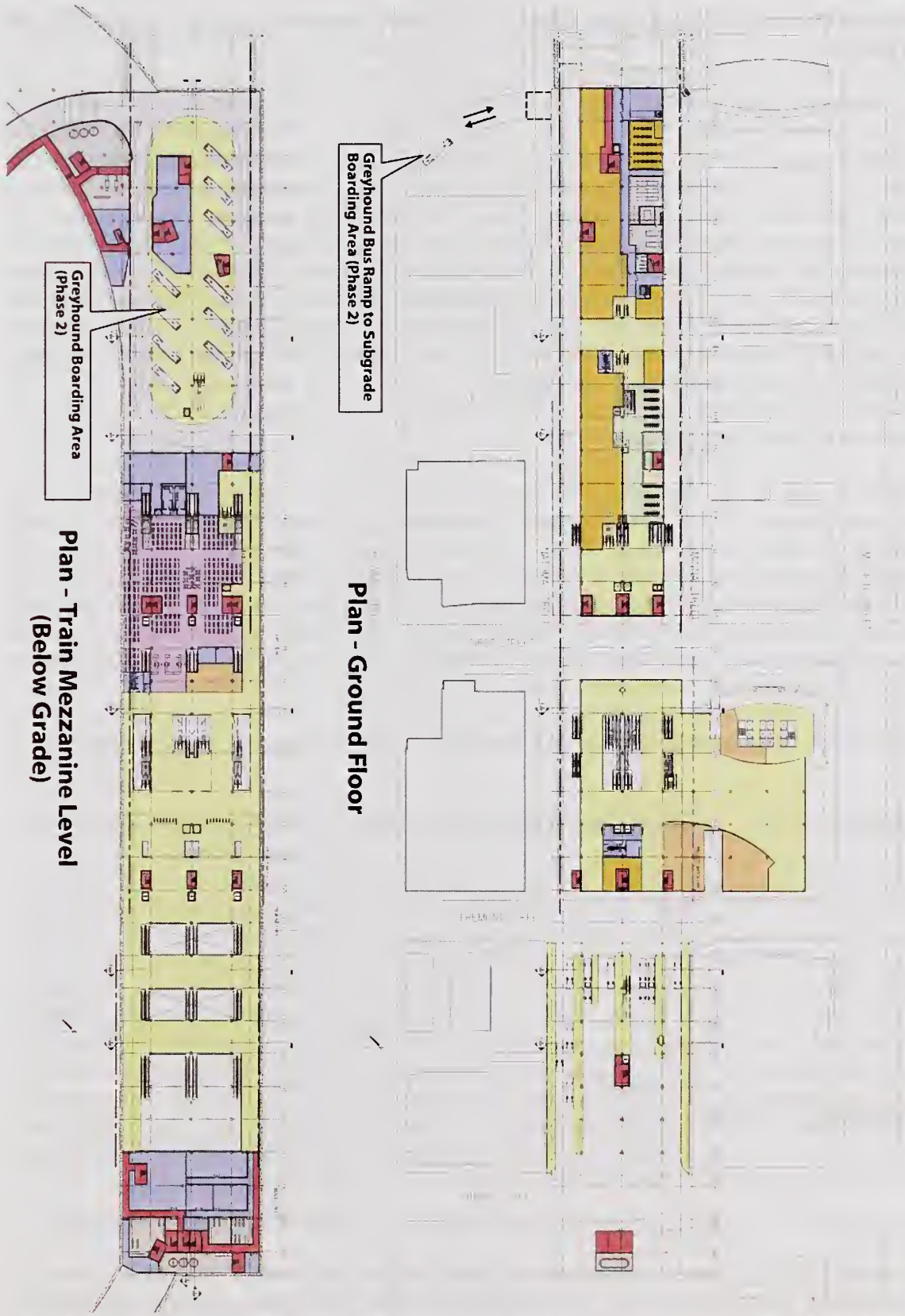



**Figure 2.6, Greyhound Permanent Boarding Area Plan and Connector Ramp**

# 3 EVALUATION OF ENVIRONMENTAL IMPACTS DUE TO THE PROPOSED CHANGES IN THE PROJECT

## 3.1 Land Use/Wind/Shadow

The Refined Project would continue to provide the beneficial land use impacts described in the Final EIS/EIR (pg. 5-2), including an intensification of land uses, freeing land for development, and enhanced pedestrian circulation in the area. The beneficial impacts would extend to creating a more vibrant and cohesive neighborhood, which is consistent with the San Francisco Planning Department and Redevelopment Agency plans, policies, and guidelines for the area (Final EIS/EIR pg. 5-12 and 5-13). Although the Refined Project would reduce the height of the TC Building, the decrease in height is not sufficient to reduce shadow and wind impacts identified for the LPA, because multiple high-rise buildings would be built on the surrounding blocks under both the LPA and the Refined Project.

## 3.2 Displacements and Relocations

The Final EIS/EIR (pg. 5-25, Figure 5.2-3) identified 564 Howard Street as property to be acquired for construction of the TC Building and associated bus ramps, however, that property was inadvertently omitted from Table 5.2-1 (pg. 5-22) and Table 5.2-5 (pg. 5-33). The displacements and relocations required for the Transbay Transit Center Building component of the LPA are discussed in the Final EIS/EIR on pages 5-22 to 5-26. The modified TC Building and associated bus ramps would continue to require the acquisition of the property at 564 Howard Street; therefore, the text of the Final EIS/EIR is hereby corrected in this addendum as shown in Table 3.2 below.

**Table 3.2, Property Acquisitions for the Transbay Transit Center Refined Project**

| Block | Lot | Address |
|---|---|---|
| Full Acquisitions | | |
| 3721 | 19 | 564 Howard Street |
| 3721 | 45A | 70 Natoma Street |
| 3721 | 46 | 78-80 Natoma Street |
| 3721 | 53 | 81 Minna Street |
| 3721 | 54 | 65 Minna Street |
| 3736 | 74 | 57 Tehama Street |
| 3736 | 88 | 60 Tehama Street |
| 3739 | 2 | Vacant Lot on Main Street |
| 3739 | 6 | 272 Main Street |
| 3739 | 4 and 7 | 200 Folsom Street |
| Partial Acquisitions | | |
| 3721 | 16 | 546 Howard Street (northeast corner) |
| 3719 | 17 | 101-129 Fremont Street (southern portion of the parcel) |

The building located at 564 Howard Street, which was constructed in 1907, has been modified substantially over the years. Regarding this building, the San Francisco Planning Department determined the following:

In 1996 the California Office of Historic Preservation assigned 562-564 Howard Street a 6Y National Register (NR) Code (Determined ineligible for NR by consensus through Section 106 process-not evaluated for California Register (CR) or Local Listing) in 1996. According to the Planning Department's CEQA Review Procedures for Historic Resources the property is considered to be Category C, "Property Determined to not be historical resources." As a result of this categorization the subject property does not qualify for California Register or Local Listing.[2]

The building at 564 Howard Street is not located in a Historic District nor is it eligible to be listed as a National Historic Resource.[3] There is currently one business, a professional office, in 564 Howard that would be displaced under both the LPA and the Refined Project. No other uses occupy the building. Because 564 Howard Street was inadvertently omitted from Table 5.2-5 on pg. 5-33 of the Final EIS/EIR, the number of offices displaced by either the LPA as reported in the Final EIS/EIR, which would remain unchanged under the Refined Project, is hereby corrected to be 10 rather than nine. The mitigation measures identified for displacement and relocation in the Final EIS/EIR (pg. 5-34), which have been adopted and incorporated into the Project, also would reduce this displacement to a less-than-significant level.

### 3.3 Socio-economics

While economic and social changes resulting from a project impact are not considered significant effects on the environment pursuant to CEQA, the following update of the discussion in the Final EIS/EIR is provided for informational purposes. The Final EIS/EIR (pg. 5-35) identified potential beneficial socio-economic impacts because of the increased activity and economic vitality generated by the LPA. Although retail uses in the TC Building would be somewhat reduced under the Refined Project, the overall beneficial socio-economic effects of the entire project, including the extensive development proposed under the Transbay Redevelopment Plan, would remain.

### 3.4 Community Facilities and Services/Safety and Security

The community facility and service impacts identified in the Final EIS/EIR (pg. 5-37 to 5-42) resulting from increased activity and uses in the Transbay Transit Center Redevelopment Area would not be substantially altered for the Refined Project, although the Refined Project includes a somewhat smaller Transit Center Building facility than the LPA. Design guidelines for lighting, pedestrian walkways, and corridor sight lines incorporated into the Transbay Transit Center design to enhance Safety and Security (Final EIS/EIR, pg. 5-122) would also be applicable to the Refined Project. The Final EIS/EIR found that no additional staff or public service capacity would be required to respond to emergencies in the study area. Since the Refined Project would somewhat reduce the scale and uses of the reconstructed TC Building and maintain the remainder of the LPA components, no new public facility, community service, or safety and security impacts would be expected under the Refined Project.

[2] Mark Luellen, Preservation Coordinator, San Francisco Planning Department, January 6, 2006

[3] Historic Architectural Survey Report for the Transbay Terminal/Caltrain Downtown Extension Project, JRP Consulting Services, Davis, California, October 25, 2001.

### 3.5 Parklands/Schools/Religious Institutions

The Final EIS/EIR (pg. 5-44 and 5-45) concluded that no long-term adverse impacts on parklands, schools, and religious institutions would occur in the study area. The Refined Project, which incorporates a lower Transit Center Building, would not alter this finding. If Greyhound remains at the Temporary Terminal until Phase 2 construction is completed, establishment of the park proposed for the midblock area on the Temporary Terminal site between Main and Beale Streets, which is a benefit of the LPA, would occur later in time. This would be a temporary and less than significant impact.

### 3.6 Air Quality

Although the Transit Center Building would be reduced in size and the Downtown Extension would be phased such that construction of the underground rail extension and station would occur after the bus terminal and ramps are completed, the level of transit service and future patronage at the Transit Center would remain as described for the LPA in the Final EIS/EIR (pg. 5-54). As a result, transit's share of the regional mode split and the reduction in vehicle miles traveled would remain the same under the Refined Project. Therefore, the Refined Project would accrue the same air quality benefits over the 20-year planning period as the LPA, and would not create any new or increased impacts on air quality. Like the LPA, the Refined Project would conform with State Implementation Plan goals.

### 3.7 Noise and Vibration

The Final EIS/EIR (pg. 5-74) found no long-term noise impacts associated with the LPA except at the Bus Storage areas. Potential vibration impacts from underground train operations were identified (Final EIS/EIR pg. 5-75 and 5-76). Mitigation measures adopted and incorporated into the LPA would reduce the impacts due to vibration to a less-than-significant level. Under the Refined Project, the project components generating noise and vibration impacts would remain, and the adopted mitigation measures would have the same effectiveness in reducing impacts to a less-than-significant level.[4] No new long-term noise and vibration impacts would be created by the proposed refinements to the Transbay Transit Center design.

### 3.8 Geology and Seismology

Under the Refined Project, the modified structural design and construction methods for the Transit Center Building would be effective in minimizing risk from seismic events and geologic conditions in the construction area, particularly during the excavation and construction of the underground train station during Phase 2.[5] No geologic or seismic impacts would occur due to the proposed refinements to the Transbay Transit Center design.

### 3.9 Water Resources and Floodplains

No long-term impacts on Water Resources or Floodplains were identified in the Final EIS/EIR (pg. 5-80 and 5-81) for the Project. The Refined Project, which is the same as the LPA except for the size and construction phasing of the Transbay Transit Center, would not change this conclusion.

[4] Hugh Saurenman, ATS Consulting, Phone Conversation, February 22, 2006.
[5] Loring Wylie, Degenkolb Engineers, Phone Conversation, February 22, 2006.

### 3.10 Utilities

The Final EIS/EIR (pg. 5-81) concluded that the LPA would not substantially increase the demand for energy or water, thereby requiring expansion of power or water facilities. A smaller Transbay Transit Center facility with reduced retail space may slightly reduce the overall water and energy consumption due to the LPA. Construction of the Refined Project would affect sewer, water, and communications lines in the same manner as disclosed in the Final EIS/EIR (pg. 5-81 to 5-83) for the LPA because the construction envelope would be the same. Phasing may delay, but not reduce, the utility impacts associated with construction of the rail extension. As indicated in the Final EIS/EIR, pg. 5-82, LPA construction activities will require utilities to be avoided, relocated, and/or supported to prevent damage to utility systems and to minimize disruption and degradation of utility service to local customers. Coordination efforts with affected utility providers will focus on identifying potential conflicts, planning utility reroutes, and formulating strategies for overcoming problems that may arise. These procedures apply to the Refined Project as well. No new or substantially increased significant impacts on utilities would occur due to the change in the Transbay Transit Center design.

### 3.11 Historic and Cultural Resources

The construction of the LPA may uncover archaeological resources. The Refined Project would be constructed within the same footprint and Area of Potential Effect (APE) as the LPA, and would have the same possibility of unearthing these resources. The procedures for recovering buried resources identified in the Memorandum of Understanding among the co-lead agencies, State Historic Preservation Officer (SHPO), and the Department of the Interior would also apply to the Refined Project (refer to pg. 5-86 to 5-89 of the Final EIS/EIR). The historic structures that would be demolished to construct the LPA and identified in the Final EIS/EIR (pg. 5-92 to 5-107) include the existing Transbay Terminal and Bay Bridge Connector ramps, which have been designated as National Historic Resources. Although the Refined Project would reduce the size of the Transit Center Building, construction of the Refined Project also would require demolition of these historic resources because the APE and construction envelope for the TC Building would be the same as for the LPA. For both the LPA and the Refined Project, the demolition of historic resources would result in significant and unavoidable impacts.

### 3.12 Hazardous Materials

Hazardous materials would be used to fuel and clean train equipment located in the Caltrain storage yard near Fourth and Townsend Streets (Final EIS/EIR, pg. 5-111). In addition, demolition of existing buildings and construction of new facilities may expose construction workers to hazardous materials. Handling of these hazardous materials would be in conformance with California OSHA (Occupational Safety and Health Administration) and local (Maher Ordinance) guidelines and procedures. The potential to encounter hazardous materials would be the same for the Refined Project and the LPA. By following appropriate procedures, impacts from hazardous materials would be reduced to a less-than-significant level.

### 3.13 Visual and Aesthetics

The visual changes associated with the LPA, such as the demolition of the existing Transbay Terminal and bus ramps, would also occur under the Refined Project. The design of the reconstructed Transit Center would be contemporary and a point of visual interest. Under both the LPA and the Revised Project, the ramps would be reduced in scale and, as such, would be less visually intrusive than what currently exists. In addition, under both the LPA and the Refined Project, the Transbay Redevelopment Plan would alter the visual landscape by allowing substantial mid-rise and high-rise development in the study area and creating parks and pedestrian walkways where none currently exist. The Final EIS/EIR (pg. 5-120) concludes that although the proposed new development would alter the aesthetic nature of the area, the added visual features are common to a built-up urban area and, by following the Redevelopment Area's Design for Development guidelines, they could enhance the visual quality of the study area, which would be a beneficial impact. The Refined Project would maintain these changes to the visual and aesthetic landscape, producing the same visual and aesthetic benefits. In addition, the Refined Project would improve the visual and aesthetic quality of the LPA by: 1) reducing the size and height of the Transit Center Building; 2) narrowing the width of the Concourse and Ground level to allow expansion of the sidewalks and public plaza area as well as greater penetration of sunlight into the interior space; and 3) eliminating the second level of the bus ramps connecting to I-80.

### 3.14 Energy

The Final EIS/EIR (pg. 5-126) found that the increased energy consumption required for the new Transbay Transit Center, underground rail facilities, expanded transit operation, and the increased uses under Transbay Redevelopment Plan would be somewhat offset by the diminished auto use and by the sustainable design elements incorporated into the Project. As a result, the Final EIS/EIR (pg. 5-126) concluded that no energy mitigation measures would be required. The Refined Project would also entail the same energy requirements and offsets, which would be further diminished by the reduced size of the Transit Center Building and the reduction in retail uses inside the Transit Center Building. Therefore, the conclusion that no energy mitigation measures would be required for the LPA would also apply to the Refined Project.

### 3.15 Transit/Traffic/Parking

The Final EIS/EIR (pg. 5-142 and 5-143) found that cumulative, adverse and unmitigated traffic impacts would occur at seven intersections in the study area. Under the Refined Project, these significant and unavoidable traffic impacts would be unchanged because most of the projected traffic volume in the study area would result from the level of development proposed in the Transbay Redevelopment Project. Mitigation measures adopted and incorporated into the Project, such as having developers of Redevelopment Area properties contribute to the City's new Integrated Management System program and Intelligent Transportation System infrastructure components, would apply to the Refined Project as well.

Upon project completion, cumulative pedestrian volumes would be the same for the LPA and Refined Project, and mitigation measures adopted and incorporated into the LPA (Final EIS/EIR, pg. 5-157) that would alleviate pedestrian impacts would apply to the Refined Project. The Refined Project would improve pedestrian circulation compared to the LPA because it would create expanded sidewalks and improve public access to and public spaces within the

Transit Center. There would be no change in parking supply due to the proposed refinements to the Transbay Transit Center design. In any event, this is not considered a significant impact under the City's applicable transportation policies.

Under the Refined Project, Greyhound would have a permanent boarding area established in the Train Mezzanine level of the new Transit Center. The underground Train Mezzanine and Station area would not be completed until Phase 2. As a result, Greyhound would need an interim boarding location. Three options for the interim boarding area are included in the Refined Project. Two of the proposed interim boarding options - the Temporary Terminal (Option 2) and Natoma Street along the West End of the Transit Center (Option 3) - would produce eight additional peak hour bus trips on City streets that do not occur under the LPA. Temporarily relocating Greyhound to the AC Transit level in Phase 1 (Option 1) would not produce any additional trips on City streets since Greyhound would use the Transit Center bus ramps to access I-80. The traffic analysis for the Temporary Terminal (Option 2 in the Refined Project) presented on page 5-184 through page 5-186 in the Final EIS/EIR indicated that intersections located between the Temporary Terminal and the Bay Bridge on-ramps would operate satisfactorily except at First/Folsom and Essex/Harrison Streets, which are projected to operate at Level of Service (LOS) F with or without bus trips from the Temporary Terminal. The Final EIS/EIR concluded that bus trips operating from the Temporary Terminal and passing through First/Folsom and Essex/Harrison would not create a cumulatively considerable contribution to the intersections' congestion. This conclusion would apply to the Refined Project as well. The eight additional Greyhound trips passing through these intersections in Options 2 and 3 would occur after operations for the other bus carriers at the Temporary Terminal have ceased and have been relocated to the Terminal at the end of Phase 1, thereby removing these bus trips from congested intersections.[6]

After Phase 2 is completed, Greyhound would access its permanent boarding area in the Terminal via a new driveway located on Howard Street 250 feet east of Second Street and used exclusively by Greyhound buses. An analysis of Greyhound operation along Howard Street found that the addition of eight peak hour inbound and outbound Greyhound trips during the afternoon peak would not affect the movement of traffic along Howard Street nor substantially affect operations (projected to operate at LOS D under 2020 cumulative conditions) at the intersection of Second/Howard Streets.[7] In addition, the analysis found that Greyhound buses turning into and out of the Transit Center Building via the access driveway would not result in significant impacts to bicyclists using a bicycle lane on the north side of Howard Street because the number of Greyhound trips entering and exiting the Transit Center would be minimal. As a result, no new or substantially increased significant impacts on transit, traffic, or parking would occur due to the change in Transit Center design.

### 3.16 Construction Methods and Impacts

As stated in the Refined Project description, Transit Center construction would occur in two phases. The extended construction period would require mitigation measures identified in the Final EIS/EIR (pg. 5-184 to pg. 5-222), which have been adopted and incorporated into the LPA,

[6] Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project EIS/EIR Transportation Assessment of Change to Traffic Flow associated with the proposed Refined Locally Preferred Alternative, Technical Memorandum, Luba C. Wyznyckyj, February 22, 2006.
[7] ibid

to be applied over a longer period of time under the Refined Project. They would remain effective in mitigating construction impacts to a less-than-significant level.

To lighten the Transit Center structure and reduce costs, the Refined Project would employ alternative construction techniques for the building's foundation and structural support system. Instead of using a grid of 1,000 piles to provide the support structure for the Transit Center, approximately 125 caissons would be required. The caissons would be drilled during the first phase of construction. Any residual construction-related noise and vibration impacts on above-ground Transit Center uses, which would have resumed operation in the new Transit Center during Phase 2 construction, would be effectively mitigated as indicated in the Final EIS/EIR (pg. 5-206 to 5-214).[8] Permanent perimeter shoring walls used to support subsequent excavation and build-out of the underground train station would be installed in Phase 1. As indicated in Geology and Seismology above, the refined structural support system would minimize risk from seismic events or geologic impacts during both phases of construction.

Hauling of excavation materials, as well as delivery and staging of construction materials, would occur as indicated in the Final EIS/EIR, with the train station construction occurring in tandem with the construction of the underground rail alignment from Fourth and Townsend Streets. By phasing rail construction, project staging areas and hauling routes would need to be maintained for a longer period of time under the Refined Project. This could delay development of the parcels used for construction staging, which is a benefit of the LPA, until Phase 2 construction is completed. Mitigation measures that require identifying truck routes and temporary street detours (Final EIS/EIR pg. 5-192 to 5-200), which were previously adopted and incorporated into the LPA, would mitigate hauling and construction-related access and circulation impacts to a less-than-significant level and would also apply to the Refined Project.

## 4 ENVIRONMENTAL FINDINGS

Based on the above information and analysis, the proposed revisions to the LPA (Refined Project) would not trigger the need for subsequent environmental review pursuant to Public Resources Code section 21166 and Section 15162 of CEQA Guidelines. The proposed changes in the Refined Project would not require major revisions of the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project Final Environmental Impact Statement/ Environmental Impact Report (FEIS/EIR) due to new or substantially increased significant environmental effects; no substantial changes have occurred with respect to the circumstances under which the Refined Project would be undertaken that would require major revisions of the FEIS/EIR due to new or substantially increased significant effects; and there has been no discovery of new information of substantial importance that would trigger or require major revisions of the FEIS/EIR due to new or substantially increased significant effects. In addition to the benefits that would be provided by the approved Project, the proposed Refined Project would provide the following environmentally beneficial effects:

- Reduced height and size of the building
- Reduced height and visual intrusion of the connecting bus ramp with I-80
- Expanded adjacent sidewalks and public access, including improved access for taxi and paratransit services
- Greater penetration of sunlight into the interior of the Transit Center Building

[8] Hugh Saurenman, ATS Consulting, Phone Conversation, February 22, 2006.

- Increased customer service and public waiting areas in the western end of the Transit Center Building

## 5 REFERENCES

Final Massing Study for the Transit Center Building, Transbay Joint Powers Authority, February 16, 2006.

Historic Architectural Survey Report for the Transbay Terminal/Caltrain Downtown Extension Project, JRP Consulting Services, Davis, California, October 25, 2001.

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Recommended Program Implementation Strategy. Transbay Joint Powers Authority, February 10, 2006.

Saurenman, Hugh. ATS Consulting, Phone Conversation, February 22, 2006.

Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project Final Environmental Impact Statement/ Environmental Impact Report and Section 4(f) Evaluation (SCH #95063004), March 2004.

Wylie, Loring. Degenkolb Engineers, Phone Conversation, February 22, 2006.

Wyznyckyj, Luba C. Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project EIS/EIR Transportation Assessment of Change to Traffic Flow associated with the proposed Refined Locally Preferred Alternative, Technical Memorandum, February 22, 2006.

# Appendix

# Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project EIS/EIR Transportation Assessment of Change to Traffic Flow associated with the proposed Refined Locally Preferred Alternative Technical Memorandum

**LCW Consulting**

# Memo

**To:** Mark Weisman, URS

**From:** Luba C. Wyznyckyj

**Date:** March 7, 2006

**Re:** Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project EIS/EIR Transportation Assessment of Changes to Traffic Flow associated with the proposed Refined Locally Preferred Alternative

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## 1. INTRODUCTION

This memorandum presents an assessment of the changes to vehicular traffic flow associated with the Refined Locally Preferred Alternative (RLPA) under consideration for adoption by the Transbay Joint Powers Authority (TJPA), within the context of the transportation analysis conducted for the *Transbay Terminal/Caltrain Downtown Extension/ Redevelopment Project Final EIS/EIR,* March 2004 (Case No. 2000.048E). The Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project is referred to in this memorandum as the "Transbay Project". The changes include elimination of the top level of the planned Transbay Transit Center building (TC Building). Greyhound bus operations would be relocated to a permanent location at the west end of the below-grade Train Mezzanine level of the TC Building. Other paratransit and private bus operators planned to use the top level of the TC Building would be relocated to the AC Transit level and share space with AC Transit.

The transportation analysis in the *Final EIS/EIR* assumed that the Greyhound and miscellaneous bus operators would be located on the top level of the TC Building and would have direct access to the building from elevated bus ramps connecting with I-80. Access to the bus ramps from surface streets would be via the Bus Storage Facility Link Ramp at the new bus storage area, located at Third Street and Stillman Street. These ramps would be used by Greyhound, paratransit and private operators' buses traveling to and from U.S. 101 northbound and southbound via I-80, which would require travel via the I-80 ramps and surface streets.

The TJPA is also considering adopting a program implementation strategy that would phase construction of the TC Building in two major phases. Phase 1 would include the above-grade portion of the TC Building. Construction of the below-grade portion of the TC Building that would house the Train Station and Greyhound bus operations area would occur in Phase 2. Until the completion of Phase 2 construction, Greyhound would continue operations at a temporary location.

This memorandum assesses the potential impacts of the relocation of the Greyhound operations for Phase 1 conditions, during which time only the above-grade bus terminal structure is constructed and occupied, and for Phase 2 conditions, when the above-grade terminal and below-grade rail terminal are both constructed and occupied.

Upon completion of Phase 2, Greyhound would move to the permanent boarding area located to the west end of the train mezzanine level, below the ground floor public customer service waiting and ticketing areas (See attached drawings A100 Refined LPA Illustrative Site Plan, and A101 Refined LPA Train Platform and Mezzanine Level Plans).

## 2. PROJECTED GREYHOUND BUS ACTIVITY

Projections of Greyhound activity during the weekday PM peak hour was based on *New Transbay Terminal Building Program Update, Section 6.0 Space Needs and Functional Requirements.* During the PM peak hour, there are projected to be a total of 111 inbound and 333 outbound passenger trips, results in a total of 444 passenger trips to and from the terminal. Assuming an average of 40 passengers per bus, there would be a maximum of 8 inbound and 8 outbound bus trips entering and exiting the terminal during the weekday PM peak hour.

## 3. PHASE 1 GREYHOUND OPERATIONS

The *Final EIS/EIR* assumed that the Temporary Terminal would be in operation for approximately five years while the new TC Building is under construction. When the new TC Building begins operation is was assumed that all bus operations at the Temporary Terminal would relocate to the TC Building, and the Temporary Terminal would be demolished.

Under the RLPA currently under consideration, following construction of Phase 1 all bus operators would relocate to the TC Building, with the possible exception of Greyhound. Under Phase 1 of the RLPA three location options are being considered for temporary Greyhound operations until a permanent location for Greyhound is constructed in Phase 2, including:

A) Greyhound Remaining for an extended period at the Temporary Terminal,
B) Relocating Greyhound to the AC Transit level in Phase 1 with scheduled sharing of bus berths with AC Transit, and
C) Relocating Greyhound to the western end of Phase 1 of the new TC Building at the ground floor level.

### 3.1 Relocating to the AC Transit Level

Relocating Greyhound operations to the AC Transit level in Phase 1 would not result in substantial changes to Greyhound bus operations or access as proposed in the *Final EIS/EIR.* Access to and from the Transbay Terminal Center building would still be via the ramps connecting with I-80 or through Bus Storage Link Ramps through the bus storage area at Third Street and Stillman Street, as anticipated in the certified *Final EIS/EIR.*

**3.2 Remaining for an Extended Period at the Temporary Terminal until Phase 2 is complete**

The *Final EIS/EIR* included a discussion of the construction impacts associated with the Transbay Project, which included the analysis the impact of the temporary terminal operations on the intersections in the vicinity of the temporary terminal. This analysis assumed that all buses using the existing Transbay Terminal would use local streets to gain access to their specified temporary terminals.

Two options for location of Greyhound operations at the Temporary Terminal are under consideration. Drawing A132 shows the option that would locate the Greyhound operations on Assessors Block 3738, bounded by Folsom, Beale and Fremont Streets, referenced in Figure 2.2.8 of the *Final EIS/EIR*. Drawing A142 shows another option currently under study that would locate Greyhound on Assessors Block 3739, bounded by Folsom, Main, Beale and Howard streets. To make room for Greyhound on this block, some AC Transit buses would move across the street to the block bounded by Folsom, Beale and Fremont Streets.

Drawing A413 shows an enlarged partial site plan of the concept shown in Drawing A142, with Greyhound operations on the center of Assessors Block 3739, with passenger access on Beale Street. Location of Greyhound as shown in Drawing A413 would be preferred if Greyhound would need to continue operations at the Temporary Terminal until Phase 2 is complete.

The street segment of Beale Street between Folsom and Howard Streets, and Main Street between Folsom and Howard Streets, would be converted to two-way traffic to allow bus loading zones and curbside public access at the Temporary Terminal. The contra-flow bus-only lane established on Folsom Street extending from Main Street to Essex Street and passing adjacent to the Temporary Terminal would remain as originally planned in the *Final EIS/EIR*. The contra-flow bus-only lanes would allow bus circulation and passenger bus stops on all four sides of the Temporary Terminal.

Access to the temporary terminal would be through Folsom and Howard streets for the option shown in Drawing A413, and from Folsom, Fremont and Beale streets for the option shown in Drawing A132. The analysis in the *Final EIS/EIR* assumed the provision of a westbound contra-flow lane on Folsom Street to serve primarily AC Transit and Greyhound buses traveling from the Temporary Terminal to the eastbound I-80 on-ramps at First and Essex streets. The intersection analyses for PM peak hour operations indicated that, in general, intersection operating conditions with the temporary terminal operations would be acceptable, except at the intersections of First/Folsom and Essex/Harrison which would operate at LOS F without and with the bus trips. It was determined that the traffic generated by the temporary terminal operations would not represent a considerable contribution to operations under existing conditions, and that there would be no significant traffic impacts at these intersections.

If Greyhound operations were to remain at the temporary terminal currently proposed for Greyhound operations for an extended period, the 8 inbound and 8 outbound bus trips during the PM peak hour would not substantially affect traffic operations. The number of Greyhound bus trips would be substantially fewer than the total number of bus trips analyzed in the *Final*

*EIS/EIR* for temporary terminal operations, and therefore the conclusion that there would be no severe traffic impacts would remain.

### 3.3 Temporarily Relocating Greyhound to the Western End of the Terminal at the Ground Floor Level

Under this option, Greyhound temporary operations during Phase 1 would be relocated to a dedicated curb area on Natoma Street as shown in Drawing A213. Natoma Street operates as a one-way eastbound alley, and buses would access Natoma Street from westbound Howard Street via a new driveway, and would leave Natoma Street to access First Street southbound at an unsignalized intersection. In this option, buses would travel to the I-80 on-ramp via First Street, and from the I-80 off-ramp via Fremont and Howard Streets.

As indicated above, the addition of 8 inbound and 8 outbound bus trips to the surface streets is not anticipated to contribute to significant worsening of operating conditions at nearby study intersections. It is likely that Greyhound buses would travel through intersections that would operate poorly (e.g., the intersection of First/Folsom Street to access I-80 eastbound), but the vehicle contribution would be minimal and the bus operations would not adversely affect traffic operating conditions.

## 4. PHASE 2 GREYHOUND OPERATIONS

The transportation analysis included in the *Final EIS/EIR* was conducted for future year 2020 conditions. As indicated in the *Final EIS/EIR,* the San Francisco County Transportation Authority (SFCTA) countywide travel demand forecasting model (SFCTA Model) was used to develop the travel forecasts for development and growth through the year 2020 in the region, as well as to determine the travel demand to and from the South of Market area (area roughly bounded by The Embarcadero, Market Street, South Van Ness Avenue and King Street).

The traffic impact analysis for the Transbay Project analyzed 27 study intersections in the South of Market area. Under 2020 Baseline plus Project and 2020 Cumulative conditions, the Transbay Project's contribution was considered significant at seven of the 27 study intersections. While improvements at individual intersections may reduce localized congestion somewhat, they may not mitigate operating conditions to less than significant levels. As a result of constraints at downstream intersections and the I-80/U.S. 101 on-ramps and mainline, mitigation measures for the seven intersections were not proposed and the impacts associated with the Transbay Project were considered significant and unavoidable.

Table 1 presents the year 2020 Cumulative operating conditions at intersections in the immediate vicinity of the Transbay Transit Center, and indicates whether that Transbay Project was determined to contribute to the significant adverse impacts at intersections operating at LOS E or LOS F conditions. Of the 13 study intersections in the vicinity of the Transbay Transit Center (and through which Greyhound buses may travel), 9 intersections would operate at LOS E or LOS F conditions, and the Transbay Project was determined to contribute to significant cumulative impacts at 4 of the 9 intersections.

**Table 1**
**2020 Cumulative Conditions – Weekday PM Peak Hour**
**Intersection Operating Conditions and Project Impact Determinations**

| Study Intersection | Avg Delay per Vehicle / LOS | Project Impact Determination |
|---|---|---|
| Second/Mission | 31.6 / D | – |
| First/Mission | > 60 / F | Significant Impact |
| Fremont/Mission | 30.5 / D | – |
| Second/Howard | 27.3 / D | – |
| First/Howard | > 60 / F | Significant Impact |
| Fremont/Howard | 42.4 / E | Significant Impact |
| Second/Folsom | > 60 / F | Significant Impact |
| First/Folsom | > 60 / F | Not a Significant Impact |
| Fremont/Folsom | 26.8 / D | – |
| Second/Harrison | > 60 / F | Not a Significant Impact |
| Essex/Harrison | > 60 / F | Not a Significant Impact |
| First/Harrison | > 60 / F | Not a Significant Impact |
| Fremont/Harrison | > 60 / F | Not a Significant Impact |

Source: *Transbay Terminal/Caltrain Downtown Extension/ Redevelopment Project Final EIS/EIR,* March 2004 (Tables 5.19-3 and 5.19-4).

Under proposed Phase 2 operations, Greyhound buses would use surface streets to travel between the terminal at the train mezzanine level and either I-80 or U.S. 101, and would travel though some intersections identified above that would operate at LOS E or LOS F, and to which the Transbay Project was determined to contribute to significant impacts. The distribution of buses using I-80 versus U.S. 101 is not known. Buses accessing the driveway on Howard Street would travel from either the I-80 westbound off-ramp at Fremont Street, or from the I-80 eastbound (U.S. 101 northbound) off-ramp at the intersection of Fourth/Bryant. Buses traveling to the site from the different freeway off-ramps would use different streets, however, all inbound buses would travel through the intersection of Fremont/Howard which would operate at LOS E under 2020 Cumulative conditions, and which the Transbay Project would adversely impact. The addition of up to 8 bus tips through these intersections during the PM peak hour would not substantially change the results of the intersection LOS analysis in the *Final EIS/EIR*.

Howard Street between First and Second Streets contains four westbound travel lanes, and the intersection of Howard/Second is projected to operate at LOS D during the 2020 Cumulative weekday PM peak hour conditions. As noted above, up to 8 inbound bus trips would travel westbound on Howard Street and turn right into the driveway connecting to the below-grade Greyhound operations area within the TC Building. The arrival of 8 buses during the PM peak hour would not result in substantial queuing into the driveway, as this driveway would only serve Greyhound buses.

Buses leaving the terminal would be required to turn right onto Howard Street westbound. The driveway would be located about 250 feet east of the intersection of Second/Howard, which

would provide a sufficient merge distance for buses continuing westbound on Howard Street or turning left onto Second Street southbound. The addition of up to 8 outbound bus trips during the PM peak hour would not substantially affect operations at the intersection of Second/Howard (projected to operate at LOS D under 2020 Cumulative conditions), and would not substantially increase traffic volumes at intersections operating at LOS E or F under the 2020 Cumulative conditions.

It should be noted that a bicycle lane is located on the north side of Howard Street, and the new driveway access would increase the potential for conflicts between bicyclists and buses. The driveway would only serve Greyhound operations, which would therefore limit the potential for increased conflicts, and Greyhound operations on Howard Street would not result in significant impacts to bicyclists.

Exhibit 2

**Second Addendum to the**
**Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project**
**Final Environmental Impact Statement/Environmental Impact Report**
**(SCH #95063004)**

In April 2004, the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project FEIS/EIR (SCH #95063004) was certified by the City and County of San Francisco, the Peninsula Corridor Joint Powers Board, and the San Francisco Redevelopment Agency. A first addendum to the FEIS/EIR (dated May 25, 2006) was adopted by the TJPA Board on June 2, 2006 pursuant to the Section 15164 of the Guidelines implementing the California Environmental Quality Act (CEQA), Public Resources Code sections 21000 *et seq.*[2] This document constitutes the second addendum to the FEIS/EIR pursuant to the Guidelines, Section 15164.

The proposed Refined LPA (RLPA) for the Caltrain Downtown Extension (DTX) Project (hereinafter, "DTX RLPA") (shown in Figure 1 attached hereto) consists of the following changes to the LPA:

- Two track lead on the surface and below ground leading to the DTX tunnel system to just before the Fourth and Townsend Streets underground station;
- Three tracks beginning at the Fourth and Townsend Streets underground station and continuing to the throat section approaching the Transbay Transit Center where the three track system splays out to six tracks to accommodate the six platform berthing locations within the station;
- At-grade rail car storage within the existing Caltrain rail storage yard rather than underground storage, which would reduce the amount of underground construction associated with the project and would not significantly change the existing use of the rail storage area;
- Design provisions to allow for a future connection to the cut and cover tunnel on Townsend Street that will facilitate construction of future system capacity for both Caltrain and High Speed Rail (HSR), and will be capable of accommodating the construction of a future Townsend Street/Embarcadero/Main Street loop with minimal disruption to ongoing rail service; and
- Delay in construction of the tail tracks, pending the outcome of future planning studies related to accommodating HSR and optimizing concurrent Caltrain and HSR operations, which would reduce the amount of underground construction within the project footprint analyzed in the FEIS/EIR at this time.

All of the changes proposed in the DTX RLPA would consist of a reduction in the size of various elements of the DTX project or rearrangement of uses within the project area previously analyzed in the FEIS/EIR, and would not change the magnitude of the environmental impacts disclosed in the FEIS/EIR. As described in the FEIR/EIS, Table 5.20-3, Pg 5-163, the approved LPA includes cut and cover construction along Townsend Street between Fourth and Fifth Streets up to Second Street.

[2] The CEQA Guidelines are found at California Code of Regulations, title 14, sections 15000 *et seq.*

Therefore, the DTX RLPA would not require major revisions to the FEIS/EIR due to new or substantially increased significant environmental effects. Furthermore, there have been no substantial changes with respect to the circumstances under which the DTX RLPA would be undertaken that would require major revisions of the FEIS/EIR due to new or substantially increased significant environmental effects; and there has been no discovery of new information of substantial importance that would trigger or require major revisions to the FEIS/EIR due to new or substantially increased significant environmental effects. Therefore, no subsequent or supplemental environmental impact report is required prior to approval of the DTX RLPA.

Figure 1: Refined Locally Preferred Alternative (RLPA)

Exhibit 3

# Third Addendum to the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project Final Environmental Impact Statement/Environmental Impact Report (SCH #95063004)

## INTRODUCTION

In April 2004, the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project FEIS/EIR (SCH #95063004) was certified by the City and County of San Francisco, the Peninsula Corridor Joint Powers Board, and the San Francisco Redevelopment Agency.

1. A first addendum to the FEIS/EIR (dated May 25, 2006) was adopted by the TJPA Board on June 2, 2006, pursuant to Section 15164 of the Guidelines implementing the California Environmental Quality Act (CEQA), Public Resources Code sections 21000 *et seq.*, describing modifications to the Transbay Transit Center design and construction staging and revisions to the Temporary Terminal site plan.
2. A second addendum to the FEIS/EIR, pursuant to the Guidelines, Section 15164, describing refinements to the Locally Preferred Alternative (hereinafter, RLPA) for the Caltrain Downtown Extension Project (DTX), including design provisions that are capable of allowing construction of a future Townsend/Embarcadero/Main loop track and delay in the timing of construction of tail tracks on Main Street pending the outcome of future rail planning studies to accommodate California High-Speed Rail. The second addendum was adopted by the TJPA Board on April 19, 2007.

## DESCRIPTION OF THIRD ADDENDUM

This third addendum to the FEIS/EIR describes modifications to the acquisition of one private property identified in the Final EIS/EIR for acquisition. The property is required for construction staging and is identified in Figure 1.

**546 Howard Street** (Block 3721, Lot 16)**:**

The property at 546 Howard Street, identified on page 5-22 of the Final EIS/EIR for partial acquisition, will be needed in its entirety for construction staging. As a result, the entire property would be acquired.

The property at 546 Howard is currently an undeveloped lot used for surface parking. The acquisition of the entire lot would remove more surface parking than would the partial property acquisition. The San Francisco Planning Code section 161(c), however, does not require the provision of off-street parking for any use in the downtown, in light of the compact and congested nature of the area. Moreover, the removal of surface parking is not considered a significant physical impact on the environment under CEQA. The full acquisition would not substantially change the severity or significance of the environmental

impacts disclosed in the Final EIS/EIR. Therefore, the acquisition of 546 Howard in its entirety would not require major revisions to the Final EIS/EIR due to new or substantially increased significant environmental effects because of substantial changes in the project, substantial changes with respect to the circumstances under which the RLPA would be undertaken, or significant new information.

The 546 Howard property is located immediately adjacent to the existing bus ramp connecting the Transbay Terminal building to the Bay Bridge. At the time that the FEIS/EIR was prepared, there was a one-story building on the property, which has since been demolished by the owner. The demolition permit was filed on November 9, 2001 (Permit Application No. 200111092798), a permit was issued on August 5, 2004, and final inspection of the demolition was approved on September 29, 2004. The FEIS/EIR Table 5.2-1 and Figure 5.2-3 identify the parcel for partial acquisition, stated as a "(f)ew feet from northeast corner of building." The partial acquisition was needed to support work in demolishing the existing bus ramp and for construction of the new facilities. Construction planning indicates that the full parcel is needed during demolition for placement of contractor equipment, such as cranes, to remove the structural members of the existing bus ramps. Following demolition of the existing bus ramp, the parcel is needed to serve as field offices, lay down areas and other construction-related staging uses required for construction of the new Transbay Transit Center.

**Conclusion**

The removal of surface parking that will occur with the acquisition of 546 Howard Street is not considered a significant environmental impact. The acquisition of this property would not substantially change the severity or significance of the environmental impacts disclosed in the FEIS/EIR.

Therefore, the acquisition of property described in this addendum would not require major revisions to the FEIS/EIR due to new or substantially increased significant environmental effects. Furthermore, there have been no substantial changes with respect to the circumstances under which these property acquisitions would be undertaken that would require major revisions of the FEIS/EIR due to new or substantially increased significant environmental effects; and there has been no discovery of new information of substantial importance that would trigger or require major revisions to the FEIS/EIR due to new or substantially increased significant environmental effects. Therefore, no subsequent or supplemental environmental impact report is required pursuant to CEQA Guidelines sections 15162 and 15163 prior to approval of the acquisition of property as described in this addendum.

**Figure 1 Location of 546 Howard Street, San Francisco, CA**

Exhibit 4

# Fourth Addendum to the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project Final Environmental Impact Statement/Environmental Impact Report (SCH #95063004)

## INTRODUCTION

In April 2004, the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project FEIS/EIR (SCH #95063004) was certified by the City and County of San Francisco, the Peninsula Corridor Joint Powers Board, and the San Francisco Redevelopment Agency.

Pursuant to Section 15164 of the guidelines implementing the California Environmental Quality Act (CEQA), the following addenda to the FEIS/EIR have been prepared.

- A first addendum to the FEIS/EIR identified modifications to the Transbay Transit Center design and construction staging and revisions to the Temporary Terminal site plan. The first addendum was adopted by the Transbay Joint Powers Authority (TJPA) Board of Directors on June 2, 2006.

- A second addendum revised the Locally Preferred Alternative for the Caltrain Downtown Extension Project (DTX), including design revisions to allow future construction of a Townsend/Embarcadero/Main Loop and to allow a delay in construction of tail tracks on Main Street pending the outcome of future rail planning studies to accommodate California High-Speed Rail. The second addendum was adopted by the TJPA Board on April 17, 2007.

- A third addendum amended the list of properties identified for full acquisition to include 546 Howard Street, which was identified in the FEIS/EIR for partial acquisition. The third addendum was adopted by the TJPA Board on January 17, 2008.

This document constitutes the fourth addendum to the FEIS/EIR.

## SUMMARY DESCRIPTION OF FOURTH ADDENDUM

The fourth addendum describes proposed modifications to the Temporary Terminal (referred to as the Revised Temporary Terminal). As indicated on page 2-21 of the FEIS/EIR, the Temporary Terminal is an interim surface facility that would replace the Transbay Terminal during its demolition and reconstruction. Beginning in 2009, all buses currently serving the Transbay Terminal would use the Temporary Terminal until the new building and bus ramps are reconstructed. As indicated in the FEIS/EIR, the structures will be removed as soon as bus operations are relocated to the Transit Center, and the land can be developed for multistory residential buildings and a park.

Although the purpose and function of the Temporary Terminal remains as stated in the FEIS/EIR, pursuant to the proposed project revisions, the configuration of the terminal, boarding platforms and waiting areas, bus staging areas, and street design has changed. Instead of being located on two adjacent blocks, the Revised Temporary Terminal will be confined to one block, bounded by Howard, Main, Folsom, and Beale streets. The Revised Temporary Terminal will contain AC Transit and Greyhound operations in separate operating areas and facilities (**Figure 1**).

The consolidated operation of buses onto one block requires the reconfiguration of the bus operating areas and circulation patterns described in the FEIS/EIR (pages 2-21 and 5-184). In the revised scenario, AC Transit uses a center boarding facility that contains a 1,030-square-foot office building and a 700-square-foot security office in a landscaped plaza in the northern portion of the block. The temporary structures, which would be demolished when the Temporary Terminal ceases operation, have shallow foundations and minimal (14-foot) heights. The AC Transit area contains 18 bus bays, 17 designated for AC Transit and 1 for WestCAT. The bus bays are sheltered by overhead canopies. Appropriate signage, ticketing kiosks, transit information, bike racks, restrooms, and waste receptacles accompany the boarding areas. Newly established utility lines that serve the bus facilities connect with existing lines along and under the surrounding streets. A two-way circulation area for buses surrounds the center boarding facility. Three specially designated walkways connect the perimeter of the block with the center boarding facility. As indicated in the FEIS/EIR, all pedestrian access and passenger facilities meet the requirements of the Americans with Disabilities Act. Landscaping is included at key points along the block perimeter.

The south end of the block bordering Folsom Street contains Greyhound operating facilities including an 8,550–square-foot office structure with ticketing, waiting area, restroom, baggage, and trash facilities. Similar to the AC Transit facilities, the temporary structure has a low elevation (16 feet) and shallow foundations, and is serviced by utility lines extending from the street right-of-way. Greyhound uses 8 bus bays sheltered by 28-foot canvas canopies. An exclusive 190-foot-long passenger pick-up and drop-off lane is located in front of the Greyhound building off Folsom Street.

Access to the AC Transit and Greyhound boarding areas is provided mid-block along Beale Street (refer to **Figure 1**). All buses exit on Folsom Street on the east end of the block adjacent to a staging area for SamTrans buses. SamTrans also has staging areas along the north side of Folsom Street between Beale and Essex streets; these staging areas are shared with the Caltrans bike shuttle.

Boarding areas on the curbside of the surrounding blocks have also been modified from those described in the FEIS/EIR (page 2-21). In the revised scenario, SamTrans and Golden Gate Transit have separate staging areas on the east side of Main Street (refer to **Figure 1**). They share a boarding area, including a passenger shelter on the sidewalk, along Main near Howard Street. Across the street, Muni has a staging area and a boarding island that separates two lanes of northbound traffic from a bus lane on the west side of the street. Additional stops for Golden Gate Transit are located on the north side of Howard Street at Fremont Street and for Muni along Howard Street in front of the Temporary Terminal. Muni is also allotted stops along the east side of Main Street north of Howard Street and the west side of Beale Street, and a boarding island on Beale Street just south of Howard Street. Muni shares the west side of Beale Street with carpool pick-up. Paratransit services are designated along the south curb on Howard Street.

The proposed project revisions would add bus lanes on Howard Street (eastbound direction) and would modify bus lanes on Beale Street to allow travel in both southbound and northbound directions between Howard and Folsom streets. Immediately north of Howard Street, Beale Street is redesigned to accommodate two bus lanes on the east side of the street and one lane on the west side with traffic confined to the two center lanes. The reconfigured bus lanes facilitate bus turning movements onto Howard and circulation into the bus lane on Beale Street south of Howard Street.

As indicated in the FEIS/EIR (page 2-23), buses coming off the Bay Bridge use the Harrison Street off-ramp to access the Temporary Terminal via Fremont Street, Folsom Street, and the bus lane on the east side of Beale Street. Fremont Street south of Folsom Street includes a PM peak tow-away lane on the east side of the street to allow AC Transit bus staging. Additionally, Folsom Street has a left turn pocket for Golden Gate and SamTrans bus movements onto Fremont Street. For outbound buses traveling between the Temporary Terminal and the Bay Bridge, buses depart the terminal on Folsom Street and use the Folsom Street westbound bus lane to reach Essex Street. Along Essex Street, buses continue in the southbound bus lane to reach the Bay Bridge on-ramp (refer to **Figure 1**). Bus lanes operating against the flow of traffic on these streets are in designated contra-flow lanes.

Additional modifications in the revised scenario include a PM peak bus staging area for AC Transit in one eastbound lane of Folsom Street between Fremont and Beale streets, and signal modifications along Folsom Street at First, Fremont, Beale, and Main streets and along Howard at Beale and Main streets to facilitate bus movement. **Table 1** compares the street and bus travel lane modifications for the Temporary Terminal described in the FEIS/EIR with those in the revised scenario.

**Table 1, Comparison of Travel Lane Configurations – FEIS/EIR versus Revised Temporary Terminal Analysis**

| | | FEIS/EIR (a) | | Revised Temporary Terminal (b) | |
|---|---|---|---|---|---|
| | Existing (1) | Eastbound/ Northbound (eb/nb) | Westbound/ Southbound (wb/sb) | Eastbound/ Northbound (eb/nb) | Westbound/Southbound (wb/sb) |
| **Folsom Street** | | | | | |
| Essex to First | 4 eb MF lanes | 2 eb MF lanes<br>1 wb Bus lane | | 3 eb MF lanes | 1 wb Bus lane |
| First to Fremont | 4 eb MF lanes | 2 eb MF lanes<br>1 wb Bus lane | | 2 eb MF lanes<br>1 eb Bus lane | 1 wb Bus lane |
| Fremont to Beale | 4 eb MF lanes | 2 eb MF lanes<br>1 wb Bus lane | | 2 eb MF lanes<br>1 eb Bus lane | 1 wb Bus lane |
| Beale to Main | 4 eb MF lanes | 2 eb MF lanes | 1 wb Bus lane | 2 eb MF lanes<br>1 eb Bus lane | 1 wb Bus lane |
| **Howard Street** | | | | | |
| Beale to Main | 2 eb MF lanes<br>2 wb MF lanes | No change from Existing | | 1 eb Bus lane<br>1 eb MF lane | 2 wb MF lanes |
| **Essex Street** | | | | | |
| Folsom to Harrison | 2 nb MF lanes (2)<br>2 sb MF lanes | No change from Existing | | 1 nb Bus lane | 1 sb Bus lane<br>2 sb MF lanes |
| **Beale Street** | | | | | |
| Mission to Howard | 4 sb MF lanes | | 1 sb Bus lane<br>3 sb MF lanes | (3) | 1 sb Bus left turn only lane<br>1 sb Bus thru only lane<br>2 sb MF lanes<br>1 sb MF right turn only lane |
| Howard to Folsom | 3 sb MF lanes | 1 nb Bus lane | 2 sb MF lanes | 1 nb Bus lane (partial) | 2 sb MF lanes<br>1 sb Bus lane |
| **Fremont Street** | | | | | |
| Folsom to Harrison | 1 nb MF lane<br>2 sb MF lanes | No change from Existing | | 1 nb MF lane<br>1 nb Bus lane | 2 sb MF lanes |
| **Main Street** | | | | | |
| Howard to Folsom | 3 nb MF lanes | 2 nb MF lanes | 1 sb Bus lane | 2 nb MF lanes<br>1 nb Bus lane | |

Sources:
(a) FEIS/EIR Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project, June 2004, pp. 5-190 to 5-191.
(b) Transportation Operations Report Transbay Terminal Temporary Terminal Project, March 2008.

Notes:
(1) MF = Mixed-Flow — all vehicles permitted use of travel lane.
(2) Essex Street northbound lanes currently closed due to Caltrans work.
(3) On Beale Street lane changes south of mid-block between Mission and Howard streets.

## ENVIRONMENTAL ISSUES

### Land Use, Wind, and Shadow

The Revised Temporary Terminal provides the beneficial land use impacts described in the FEIS/EIR (pg. 5-2), including the intensification of land uses, the freeing of land for development, and enhanced pedestrian circulation. Confining the Temporary Terminal to one block rather than two allows earlier development of the unused block according to guidelines specified in the Redevelopment Plan (FEIS/EIR pg. 2-44), and included in the analysis of the Redevelopment Plan in Section 5.1.1.3 of the FEIS/EIR, pg 5-5.

Development of the block where the Temporary Terminal is located will occur as described in the Redevelopment Plan. The small, temporary structures housing AC Transit and Greyhound offices and passenger facilities are low-lying structures that would not alter the wind and shadow analysis in the FEIS/EIR (pg 5-13 and 5-18).

### Displacements and Relocations

The acquisition of 272 Main Street to construct the Temporary Terminal would remain as indicated on pg 5-22 and 5-33 of the FEIS/EIR. No other properties would be acquired for the Temporary Terminal.

### Socio-economics

The beneficial socio-economic impacts resulting from the increased activity and economic vitality generated by the project would remain as described in the FEIS/EIR (pg. 5-35).

### Community Facilities and Services/Safety and Security

The Revised Temporary Terminal includes specially designated pedestrian walkways and lighting standards that enhance and integrate pedestrian circulation onto one block. The Safety and Security guidelines in the FEIS/EIR (pg. 5-122) remain applicable to the Terminal facilities constructed on one block. Consolidation of the Terminal facilities does not alter the findings in the FEIS/EIR that no additional staff or public service capacity is required to respond to emergencies in the area.

### Parklands/Schools/Religious Institutions

The Revised Temporary Terminal does not alter the finding in the FEIS/EIR (pg. 5-44 and 5-45) that no long-term adverse impact would occur to parks, schools, and religious institutions, as none of these types of facilities is located on or adjacent to the Temporary Terminal site. The parkland designated for the mid-block area of the site in the Redevelopment Plan would be constructed after bus operations are moved to the Transit Center and development of the block occurs.

### Air Quality

The consolidation of Temporary Terminal facilities onto one block is not expected to alter the mode split of regional vehicle-miles traveled as forecasted in the FEIS/EIR (pg. 5-54). As a result, the air quality benefits identified in the FEIS/EIR occur for the Revised Temporary Terminal as well. Temporary Terminal construction activities that generate dust or construction equipment emissions are reduced to a less-than-significant level employing the mitigations described in the FEIS/EIR.

**Noise and Vibration**
The FEIS/EIR (pg. 5-74) found no long-term adverse noise impacts associated with the Transbay Transit Center or bus operations, including the Temporary Terminal. This conclusion remains unchanged for the Revised Temporary Terminal because there are no changes in the location or nature of Temporary Terminal operations. Noise and vibration impacts generated by construction activities are reduced by the mitigation measures identified in the FEIS/EIR.

**Geology and Seismology**
The low-lying temporary structures on the Temporary Terminal site are designed according to the San Francisco Building Codes that make construction of these facilities effective in minimizing risk from earthquakes and geologic conditions. As a result, no seismic or geologic impacts associated with the construction and operation of the Revised Temporary Terminal are expected.

**Water Resources and Floodplains**
No long-term adverse impacts on water resources and floodplains were identified in the FEIS/EIR. Consolidating the Temporary Terminal onto one block does not change the risk of impact to water resources or floodplains from that described in the FEIS/EIR (pg. 5-80).

**Utilities and Energy**
The Revised Temporary Terminal would be served by connecting to existing utility lines that traverse the perimeter of the site. Fewer connections are required to serve the terminal on one block instead of two. However, the reduction in utility service connections, relative to the entire project, is negligible and does not alter the need for new utility service connections or energy use as indicated in the FEIS/EIR (pg. 5-81 and 5-126). As a result, the findings on utilities and energy in the FEIS/EIR are the same for the Revised Temporary Terminal, including no substantial increase in the demand for energy or water by the project.

**Historic and Cultural Resources**
The construction of the Revised Temporary Terminal may uncover archaeological resources. The consolidated footprint confines the possible discovery of artifacts to one block rather than two. The same procedures for recovery identified in the FEIS/EIR (pg. 5-86 to 5-89) apply to the Revised Temporary Terminal. In addition, the Revised Temporary Terminal, like the originally approved plan for the Temporary Terminal, would continue to require removal of the loop bus ramp leading into the existing Transbay Terminal. The bus ramp is designated as a National Historic Resource and, as indicated in the FEIS/EIR (pg.5-90), its removal is considered an adverse impact.

**Hazardous Materials**
If hazardous materials are encountered during construction of the Revised Temporary Terminal, they will be handled as indicated in the FEIS/EIR (pg. 5-111), i.e., in conformance with California Occupational Safety and Health Administration and local ordinance procedures. The potential to encounter hazardous materials is slightly reduced by the consolidated footprint of the Revised Temporary Terminal.

**Visual and Aesthetic**
The Revised Temporary Terminal incorporates landscape treatments on the AC Transit center area and around the perimeter of the block along the pedestrian realm, which is a beneficial impact. The low-lying structures, less than 18 feet tall, are confined to one block and do not alter the visual context produced by the towering buildings surrounding the site. As stated in the

summary of this addendum and in the FEIS/EIR, the structures will be removed as soon as bus operations are relocated to the Transit Center, and the land can be developed for multistory residential buildings and a park.

**Transportation**

***Traffic***

**Temporary Terminal in the FEIS/EIR.** The FEIS/EIR analyzed the impacts of Temporary Terminal operations at seven study intersections (Folsom/Main, Folsom/Beale, Folsom/Fremont, Folsom/First, Folsom/Essex, Harrison/Fremont, and Harrison/Essex). The operations of these intersections were analyzed for weekday PM peak hour conditions for 2006, the year that the Temporary Terminal was anticipated to begin operations. The operating conditions were analyzed without and with the Temporary Terminal. The San Francisco Planning Department examines the level of service (LOS) to determine impact. If intersections operate at LOS E or F (representing adverse traffic operations), additional analysis of the volume contribution of the project compared with cumulative traffic volumes without the project is conducted to determine whether the project would contribute considerably to the cumulative traffic increase (FEIS/EIR, pg. 5-140).

The analysis was conducted using a VISSUM micro-simulation traffic operations model. The analysis indicated that without and with the terminal, two intersections (**Folsom/First** and **Harrison/Essex**) would operate at unacceptable level of service (LOS) conditions (i.e., LOS E or LOS F). The contribution of the Temporary Terminal to the poor operating conditions at these intersections was determined to be less-than-significant; therefore, Temporary Terminal operations were determined to not result in any significant traffic impacts.

**Revised Temporary Terminal**. The operation of the Revised Temporary Terminal and the potential impact to adjacent streets associated with lane configuration to provide exclusive bus lanes between the Temporary Terminal and the Bay Bridge was analyzed using a VISSUM micro-simulation traffic operations model (Fehr and Peers, Transbay Terminal – Temporary Terminal Transportation Operations Report, March 2008). The model analyzed weekday PM peak hour conditions at 25 study intersections in the vicinity of the Temporary Terminal. Table 2 presents the analysis of 11 critical intersections, including a comparison of the weekday PM peak hour LOS at seven intersections studied in the FEIS/EIR and also analyzed for the Revised Temporary Terminal. Four additional intersections that are expected to operate at LOS E under the revised scenario are also included.

The intersections of Folsom/Main, Folsom/Beale, Folsom/Fremont, and Harrison/Fremont would operate at LOS D or better with the Revised Temporary Terminal.

Operations at the intersections of Howard/Beale and Folsom/Essex with the reconfiguration of roadways and Revised Temporary Terminal operations would improve from LOS E conditions without the terminal to LOS D conditions with the terminal. As a result, the Revised Temporary Terminal would not result in project-specific impacts to traffic operations at these six intersections.

**Table 2, Comparison of Intersection LOS Weekday PM Peak Hour Conditions – FEIS/EIR versus Revised Temporary Terminal Analysis**

| Intersection | FEIS/EIR | | | 2007 Revised Temporary Terminal (3) | | FEIS/EIR versus Revised Temporary Terminal |
|---|---|---|---|---|---|---|
| | Existing (1) | EIR Temporary Terminal (2) | | | | |
| | 2001 | 2006 | with Terminal | 2007 | with Terminal | Impact Determination |
| Howard/Beale | C | | | E | D | no impact |
| Howard/First | D | | | E (70) | E (70) | no impact |
| Folsom/Main | B | B | D | B | A | no impact |
| Folsom/Beale | B | B | B | B | B | no impact |
| Folsom/Fremont | B | B | B | B | C | no impact |
| Folsom/First | F | F | F | E (59) | E (64) | no significant contribution |
| Folsom/Essex | | | C | E | D | no impact |
| Harrison/Fremont | D | B | B | D | D | no impact |
| Harrison/First | F | | | E (64) | E (63) | no impact |
| Harrison/Essex | F | F | F | E (70) | E (77) | no significant contribution |
| Harrison/Second | E | | | E (76) | E (76) | no impact |

LOS (delay in seconds per vehicle), **BOLD** letters represent intersections operating at LOS E and LOS F, City significance criteria for congested conditions.
Source:
(1) FEIS/EIR Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project, June 2004, Table 3.2-1
(2) FEIS/EIR Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project, June 2004, Table 5.21-1
(3) Transportation Operations Report Transbay Terminal Temporary Terminal Project, March 2008

Under the revised scenario, the intersections of Howard/First, Harrison/First, and Harrison/Second would operate at LOS E conditions both without and with the Revised Temporary Terminal. As a result, the contribution of the Revised Temporary Terminal to the LOS E operating conditions would not be considered significant, and the Revised Temporary Terminal would not result in any project-specific impacts to intersection operations.

The intersections of Folsom/First and Harrison/Essex would also operate at LOS E conditions both without and with the Revised Temporary Terminal.

- At the intersection of Folsom/First, the traffic volume served under both without and with the Revised Temporary Terminal would be less than the existing demand; however, the volumes served would be similar for both conditions (within 1 percent of the total volume served).
- At the intersection of Harrison/Essex, under existing conditions (without the Temporary Terminal), the volume served in the VISSUM microsimulation model is more than the demand. The volume served under existing conditions would be less than without the terminal volume served, but very close to the existing demand (within 2 percent of the total intersection demand volumes).

An examination of the traffic volumes at the intersections of Folsom/First and Harrison/Essex, without and with the Revised Temporary Terminal, indicates that the difference in volume between operations without the terminal and operations with the terminal would be minimal, would not change the LOS, and would be within the daily variation in traffic volumes. Therefore, the project contribution to the LOS E conditions would not be considered significant, and the Revised Temporary Terminal would not result in any project-specific impacts to vehicle operations at these intersections.

***Transit***
The study of bus operations along the streets surrounding the terminal and within the terminal using a VISSUM micro-simulation traffic operations model concludes that the Revised Temporary Terminal traffic and bus lane configuration and consolidation of passenger boarding and waiting facilities does not impede bus operations (Fehr and Peers, March 2008). The terminal would accommodate the existing service levels provided in the existing Transbay Terminal. Sufficient capacity exists to accommodate peak period staging and the boarding of buses, although occasional delays may occur for buses that must wait for space to become available in the boarding area.

***Pedestrian***
The pedestrian environment at the Revised Temporary Terminal site will be enhanced by designated walkways connecting the perimeter of the block with the center boarding facilities. Landscaping and redesigned sidewalks will also improve the pedestrian realm. Consolidating transit operations onto one block will provide pedestrians moving between bus boarding areas with a safer and more conducive environment for accessing transit, a beneficial impact.

***Parking***
As indicated in the FEIS/EIR, curbside parking would be removed around the perimeter of the Temporary Terminal. The removal of curbside parking would not change under the revised scenario. As the FEIS/EIR concluded, the minor reduction in the downtown parking supply is not considered a significant impact under the City's applicable transportation policies.

In summary, the reconfiguration of the street system to support the Revised Temporary Terminal conditions and the Temporary Terminal bus operations would not result in significant traffic, transit, pedestrian, or parking impacts.

## ENVIRONMENTAL FINDINGS

Based on the above information and analysis, the proposed revisions to the Temporary Terminal will not trigger the need for subsequent environmental review pursuant to Public Resources Code Section 21166 and Section 15162 of the CEQA guidelines. The proposed changes to the Temporary Terminal described in this addendum would not change the magnitude of the environmental impacts disclosed in the FEIS/EIR, but would provide the following environmental benefits.

- Reduced area required for Temporary Terminal operations and the availability of the unused portion of the site for planned development to support the financing of the project earlier than envisioned in the FEIS/EIR
- Reduced risk of uncovering hazardous materials or archaeological artifacts during construction of the Temporary Terminal, due to the consolidation of bus operation to one instead of two blocks
- Reduced utilities and public service infrastructure to support Temporary Terminal operation
- Improved bus circulation and access to the Bay Bridge through additional bus lanes and bi-directional lanes to facilitate bus movement to and from the Bay Bridge ramps
- Improved intersection operation from LOS E conditions without the Temporary Terminal to LOS D conditions with the Temporary Terminal at the intersections of Howard/Beale and Folsom/Essex, due to the reconfiguration of roadways and consolidation of bus operations
- Improved pedestrian realm created by designated and well-lighted walkways, landscaped and redesigned sidewalk areas, and more safe and convenient transfers between bus boarding areas
- Improved waiting areas and public facilities at the AC Transit and Greyhound boarding areas

The revisions to the Temporary Terminal described in this addendum would not require major revisions to the FEIS/EIR due to new or substantially increased significant environmental effects. Furthermore, there have been no substantial changes with respect to the circumstances under which these modifications would be undertaken that would require major revisions of the FEIS/EIR due to new or substantially increased significant environmental effects; and there has been no discovery of new information of substantial importance that would trigger or require major revisions to the FEIS/EIR due to new or substantially increased significant environmental effects. Therefore, no subsequent or supplemental environmental impact report is required prior to approval of the revisions to the Temporary Terminal configuration and design as described in this addendum.

**Figure 1, Revised Temporary Terminal Configuration and Off-site Traffic Circulation and Lane Configuration Plan**

**Fifth Addendum to the**
**Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project**
**Final Environmental Impact Statement/Environmental Impact Report**
**(SCH #95063004)**

## I. INTRODUCTION

In April 2004, the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project Final Environmental Impact Statement/Environmental Impact Report (FEIS/EIR) (SCH #95063004) was certified by the City and County of San Francisco (the City), the Peninsula Corridor Joint Powers Board, and the San Francisco Redevelopment Agency.

Pursuant to Section 15164 of the Guidelines implementing the California Environmental Quality Act (CEQA), the following addenda to the FEIS/EIR have been prepared.

- A first addendum to the FEIS/EIR identified modifications to the Transbay Transit Center design and construction staging and revisions to the Temporary Terminal site plan. The first addendum was adopted by the Transbay Joint Powers Authority (TJPA) Board of Directors on June 2, 2006.

- A second addendum revised the Locally Preferred Alternative for the Caltrain Downtown Extension Project (DTX), including design provisions to allow future construction of a Townsend/Embarcadero/Main Loop and the delay in construction of tail tracks on Main Street pending the outcome of future rail planning studies to accommodate California High-Speed Rail. The second addendum was adopted by the TJPA Board on April 17, 2007.

- A third addendum amended the list of properties identified for full acquisition to include 546 Howard Street, which was identified in the FEIS/EIR for partial acquisition. The third addendum was adopted by the TJPA Board on January 17, 2008.

- A fourth addendum revised configuration, boarding platforms and waiting areas, bus staging areas, and street design associated with the Temporary Terminal. The fourth addendum was adopted by the TJPA Board on October 17, 2008.

## II. SUMMARY DESCRIPTION OF FIFTH ADDENDUM

The Transbay Transit Center (TTC or Transit Center) is designed to occupy portions of the public right-of-way (ROW). Accordingly, the TJPA will apply to the City and County of San Francisco to vacate the public ROW in those areas. The impacts associated with most of the TTC structures that require public ROW vacation were previously analyzed in the FEIS/EIR. *See* Section III. Accordingly, analysis of these structures will not be a part of this addendum. However, minor changes to the building design, specifically (1) exterior façade of the upper levels and (2) a pedestrian bridge over Beale Street, were not analyzed in prior environmental documents. Accordingly, a

CEQA environmental checklist was developed to address the question of whether these proposed changes to the project would trigger the need for subsequent environmental review pursuant to Public Resources Code section 21166 and sections 15162 and 15163 of the CEQA guidelines. This addendum presents the findings of the environmental checklist.

## III. PRIOR ENVIRONMENTAL REVIEW

The FEIS/EIR evaluated the following natural resources and urban systems: Land Use/Wind/Shadow, Displacements and Relocations, Socio-economics, Community Facilities and Services/Safety and Security, Parklands/Schools/Religious Institutions, Air Quality, Noise and Vibration, Geology and Seismology, Water Resources and Floodplains, Utilities, Historic and Cultural Resources, Hazardous Materials, Visual and Aesthetics, Transit/Traffic/Parking, and Construction Methods and Impacts. Analysis of cumulative impacts was included in the discussion for each topic area.

### A. Bus Ramp Overpasses

Pages 2-16 through 2-21, and 5-161 of the FEIS/EIR addressed the potential impacts associated with the bus ramps connecting the terminal, bus storage areas, and I-80. Addendum No. 1 to the FEIS/EIR found that by eliminating one bus level, the bus ramp linking the TTC with I-80 could be confined to a single-level structure replacing the two-level, stacked ramp concept described for the Locally Preferred Alternative (LPA). The addendum identified the ramp as a single-level ramp approximately 40 feet above street level and approximately 20 feet lower than the top of the stacked ramp. Thus, the current ramp configuration design consists of a single level connector between I-80 and the TTC.

### B. Train Box

The FEIS/EIR evaluated the potential environmental impacts associated with the terminal, including the train box, which was identified as a component of the project. The FEIS/EIR evaluated a train box with space to accommodate six tracks for platform berthing locations at the TTC. The train box remains in the location identified in previous environmental documents.

### C. Transit Center Bridges Over First and Fremont

Chapter 2, and pages 5-112, 5-161, and 5-208 of the FEIS/EIR addressed the environmental impacts associated with the Transit Center bus deck bridges over First and Fremont.

### D. Utility Relocation

Pages 5-81, 5-83, 5-216, and 5-164 of the FEIS/EIR addressed the potential environmental impacts associated with the relocation of utilities that will be required during construction of the TTC.

## IV. DESIGN MODIFICATIONS

### A. Basket Structures

Modifications to the Transit Center Design evaluated in this addendum include a structural shell that would undulate in a convex and concave shape, suspended from a series of "Y" columns in a curtain wall fashion (the basket structure or the baskets). This basket structure would be attached to the superstructure on the side of the proposed TTC. The structure would be suspended above the sidewalk on levels two and three, leaving the first level open for pedestrian circulation allowing for a continuous sidewalk thoroughfare underneath the TTC. The basket structure would begin approximately 18 feet above the sidewalk and gradually curve up to a height of approximately 87 feet and out to a maximum horizontal reach of approximately 16 feet from the property line. The new curved structural design is more organic in appearance than the original design, with a shape that resembles a webbed basket. This changes the original window fenestration to an exterior skin consisting mostly of transparent panels that would fill in the webbed basket with a square-grid pattern. This will allow for more daylight to filter through the building, providing a translucent appearance.

### B. Beale Street Pedestrian Bridge

This addendum also evaluates the potential addition of a pedestrian bridge spanning from the east side of Beale Street to the upper levels of the Transit Center on the west side of Beale Street. The TTC pedestrian bridge over Beale Street would connect to land currently owned by Caltrans that would be developed as part of the Redevelopment Plan for the area, as described in Chapter 2 of the FEIS/EIR. The pedestrian bridge would allow for pedestrian crossover approximately 65 feet above the street, and would still allow for continuing traffic and pedestrian circulation along Beale Street. The pedestrian bridge crossing Beale Street would not impact previously proposed vertical circulation for the TTC (*See* FEIS/EIR pp. 2-14 and 2-21). The Final EIS/EIR did not evaluate the impact of crossing Beale Street with a pedestrian bridge; however, impacts associated with this crossing would be similar to or less than the impacts associated with the bridge structure for the TTC bus deck bridge crossing over Fremont and First Streets (*See* FEIS/EIR p. 5-112 [analyzing visual and aesthetic impacts of the Transbay Terminal]). The pedestrian bridge would be at most 30 feet wide, which is approximately one-quarter to one half the width of the TTC and bus deck bridges.

Construction of the basket structures and Beale Street pedestrian bridge would occur simultaneously with, and as a part of, construction of the Transit Center. The Beale Street bridge and basket structures would be designed to the same construction standards identified in the FEIS/EIR for the TTC.

## V. PUBLIC RIGHT-OF-WAY VACATIONS

Public streets and sidewalks are owned by the City and County of San Francisco as a public right-of-way (ROW). The public ROW includes the areas above and below public streets and sidewalks. The TTC would occupy portions of the public ROW above ground, starting at approximately 18 feet, where the building, ramps, and bridges hang

over the street, and below ground where the proposed train box extends below the street. *See* Figure 1. In addition, bus ramps that connect I-80 to the Transit Center would occupy the public ROW approximately 40 feet above city streets. Because the TTC would occupy portions of the public ROW, the TJPA will apply to the City to vacate the public ROW in those areas. The proposed public ROW vacations would result in the vacated areas no longer being designated for public ROW or street uses. After vacation, the City would convey the property to the TJPA. The vacated areas would no longer be owned by the City and used as a public ROW, but instead would constitute property owned by the TJPA in fee title and occupied by the TTC. The surface level streets would remain City property for continued use as public ROWs. Traffic and pedestrian flows would only temporarily be impeded during construction, as previously evaluated in the FEIS/EIR. Pedestrian circulation will be enhanced after construction to allow for continuous passage on the street levels. In addition, during construction of the Transit Center, underground utility lines in the public ROW would need to be relocated.

The following above and below street-level vacations are necessary to allow for the TTC as now proposed:

- First Street between Minna and Natoma Streets
- Fremont Street between Minna and Natoma Streets
- Beale Street between Minna and Natoma Streets
- Minna Street between Second and First Streets
- Natoma Street between First and Second Streets
- Bus ramp overpasses at Natoma, Howard, Tehama, Clementina, Folsom and Harrison Streets

Appendix 1 shows the area of the proposed vacations, which are described in more detail below.

### A. First Street Between Minna and Natoma Streets

The project's rail station box requires the full-width of the public ROW along First Street between Minna and Natoma Streets for approximately 186 horizontal feet beginning at a depth of approximately 4'-9" below grade and extending downward vertically. During construction, utilities would be relocated on an interim basis with utilities configured in their final location over the train box at a depth no greater than approximately 4'-5" vertically.

The air space required for project's bridge structure over First Street would be approximately 18' above grade and extend to approximately 87 vertical feet to the top level of the proposed TTC, which is the roof park. The bridge would become part of a continuous platform for the Bus Deck with an extension horizontally from west of First Street to the eastside of Beale Street. The above ground vacation area on First Street between Minna and Natoma Streets would measure approximately 180 horizontal feet.

### B. Fremont Street Between Minna and Natoma Streets

The project's rail station box requires the full-width of the public ROW along Fremont Street between Minna and Natoma Streets for approximately 186 horizontal feet

beginning at a maximum depth of 4'-9" below grade and extending downward vertically. During construction, utilities would be relocated on an interim basis with utilities configured in their final location over the train box at a depth no greater than 4'-5."

The air space required for the TTC's bridge structure would be approximately 18' above grade and extend vertically skyward for approximately 87 feet to the top level of the proposed TTC, which is the roof park. The bridge over Fremont Street would become part of a continuous platform for the Bus Deck from west of First Street to the eastside of Beale Street. The above ground vacation area on Fremont Street between Minna and Natoma Streets would measure approximately 180 horizontal feet.

**C. Beale Street Between Minna and Natoma Streets**

The project's rail station box requires the full-width of the public ROW along Beale Street between Minna and Natoma Streets beginning at a maximum depth of 4'-9" vertically below grade and extending downward to the base of the train box. Vacation would include approximately 188 horizontal feet on the western side of Beale Street and approximately 220 horizontal feet on the eastern side of Beale Street. During construction, utilities would be relocated on an interim basis with utilities configured in their final location over the train box at a depth of approximately 4'-5."

The air space required for project's proposed Beale Street pedestrian bridge structure and baskets would begin approximately 18' above grade and extend vertically skyward up to approximately 87 feet to the top level of the proposed TTC. The above ground vacation area on Beale Street between Minna and Natoma Streets would measure at approximately 180 horizontal feet.

**D. Minna Street between Second and First Streets**

The project's train box would require vacation of the southern half of the public ROW from 1'-6" below grade and extending downward, beginning at the TTC property line and extending approximately 16 horizontal feet to the north along Minna Street between Second and First Streets. Utilities in the southern half of the ROW would be relocated to the northern half.

The air space required for the basket structure would be approximately 18' above grade, continuing skyward vertically up to approximately 87 feet to the top level of the proposed TTC. The basket structure would extend approximately 16 horizontal feet north of the property line over Minna Street.

**E. Natoma Street between First and Fremont Streets**

Beginning at the TTC property line and extending approximately 15 feet horizontally to the south along Natoma Street between First and Fremont Streets, the project's train box would require the north-half of the public ROW from 1'-6" below grade and extend downward vertically. Utilities in the north half of the ROW would be relocated to the southern half.

The air space required for the basket structure would be approximately 18 feet above grade, continuing skyward vertically for approximately 87 feet to the top level of the proposed TTC. The basket structure would extend approximately 16 horizontal feet south of the property line over Natoma Street.

**F. Eastern Section of Natoma Street between First and Second Streets**

From the property boundary at First Street and running westward horizontally along Natoma Street, the TTC would occupy approximately 171 horizontal feet of ROW below and above grade. Beginning at a distance of 1'-6," the below ground train box would require approximately 10' of the north-half of the public ROW as measured horizontally from the Transit Center's property boundary. Utilities in the northern half of the ROW would be relocated to the southern half of the ROW.

The air space required for the basket structure would be approximately 18' above grade, continuing skyward vertically up to approximately 87 feet to the top level of the proposed TTC. The basket structure would extend approximately 16 horizontal feet south of the property line over Natoma Street.

**G. Western Section of Natoma Street between First and Second Streets**

The project's train box would require the full-width of the public ROW along Natoma Street beginning 1'-6" below grade and extending vertically downward. The areas that would be affected would begin at approximately 59' east of the property boundary on the eastern side of intersection of Second and Natoma Streets and would continue horizontally to approximately 171' east of the western property boundary at the intersection of First and Natoma Streets. Utilities would be relocated outside of this approximately 596 horizontal-foot section of Natoma Street.

The air space required for the basket structure would be 18' above grade, continuing skyward up to approximately 87 feet to the top level of the proposed TTC, extending horizontally approximately 16' south of the property line.

**H. Bus ramp overpasses at Natoma, Howard, Tehama, Clementina, Folsom, First and Harrison Streets**

The bus ramps connecting I-80 to the TTC will cross; 1) Harrison Street between Essex and Second streets; 2) Folsom Street between Essex and Second Streets; 3) Clementina Street between Ecker and Second Streets; 4) Tehama Street between First and Second Streets; 4) Howard Street between First and Second Streets; 5) First Street between Clementina and Tehama Streets and 5) Natoma Street between First and Second Streets. The air space required to be vacated for the project's bus ramps would begin approximately 18' above grade and extend vertically to the sky. Horizontally, the bus ramps require vacation of the full-width of the public ROW at the crossings and extend lengthwise for approximately 95 feet. On First Street the vacation will extend lengthwise for approximately 30 feet.

## VI. ENVIRONMENTAL ISSUES

As discussed previously, most of the TTC structures that require public ROW vacation were previously analyzed in the FEIS/EIR. This addendum focuses on the following Transit Center design changes that require public ROW vacation: (1) the addition of exterior façade wall basket structures and (2) the addition of a pedestrian bridge over Beale Street.

### A. Land Use, Wind, and Shadow

Public ROW vacation would allow for the beneficial land use impacts described in the FEIS/EIR (pp. 5-2 and 5-3), including the intensification of land uses, the freeing of land for development, and enhanced pedestrian circulation. All streets identified in this addendum were previously evaluated for shadow impacts with the exception of the pedestrian bridge over Beale Street. The Beale Street bridge would cast a shadow smaller in extent and similar in duration to that described in the FEIS/EIR for Fremont and First Streets (FEIS/EIR pp. 5-19 to 5-21). Because the bridge would not be located near existing open space under the jurisdiction of the San Francisco Recreation and Park Commission, it would not cast shadows on City-owned open spaces (*See* FEIS/EIR and Addendum No. 1). Modifications to terminal design would comply with City Planning Code Section 148 for the reduction of ground-level wind currents as specified on page 5-18 of the FEIS/EIR. The design of the basket structure would conform to required building and planning standards. The Redevelopment Plan described and evaluated in the FEIS/EIR included future development of the block immediately to the east of the terminal along Beale Street. The extension of a pedestrian bridge over Beale Street would not limit or constrain the uses in the area and would be compatible with future development as evaluated by the Redevelopment Plan for the area. Pedestrian circulation will be maintained along the street.

The City's General Plan Urban Design Element Policy 2.8 creates a presumption against vacating street areas. Policy 2.9 lists criteria under which a vacation may occur. Under Policy 2.9(B), vacations for the baskets and pedestrian bridge may be considered favorably. The basket structures enhance the visual appeal of the TTC and will enhance the character of the TTC as a visual focal point for the Transbay Redevelopment Project area. The baskets also further the public values of streets; they do not interfere with adequate light and air to pedestrians below the baskets, and provide views to the outside for people within the TTC. The bridge over Beale Street is a small-scale pedestrian crossing. It will span from one side of Beale street to the other, and be at most 30 feet wide, and likely less. The bridge is necessary for public access to and from the Transit Center. It will connect to a proposed building on the east side of Beale, which would provide for egress from the underground train box levels of the TTC. Pedestrian access to the retail and park levels of the TTC would be facilitated by providing a means to cross Beale Street. Additional access to the rooftop park will encourage use of the park.

Vacation for the baskets and pedestrian bridge are also consistent with the criteria listed in Urban Design Element Policy 2.9(A). Because the design modifications will only occupy air space, they will not eliminate street space, disrupt vehicular or pedestrian circulation, or interfere with the rights of access to private property. Further, because the

pedestrian bridge will improve access to the 5.4 acre park atop the TTC, it will enhance public recreation activities and open space. The impacts on the scale and character of the surrounding development will be similar to the visual and aesthetic impacts discussed for the TTC in the FEIS/EIR, pages 5-112-121. The basket structures will begin approximately 18 feet above the streets and the pedestrian bridge will be located approximately 65 feet above the street. This is sufficient clearance to allow emergency vehicles to access the streets. Overhead trolley lines currently exist on Beale Street. The TJPA is working with the MTA to permanently relocate those utilities and will reimburse the MTA for relocation costs. The basket structures and pedestrian bridge do not add to the height of the building. Although the basket structures increase the width of the Transit Center, they add visual interest and appeal to the building design.

There is not a significant view along Beale Street that would be obstructed or diminished by the pedestrian bridge. Currently, the view looking southwest along Beale Street from the corner of Mission and Beale Streets is impeded by the existing Transbay Terminal bus ramps. Beyond the bus ramps is the Harrison Street and I-80 freeway crossings over Beale. Existing buildings obstruct the view from Beale Street to Rincon Hill. The view northwest from Howard and Beale Streets similarly is impeded by the existing bus ramps. Beyond the bus ramp is a view of highrise buildings. Similarly, the views looking up and down Minna and Natoma Streets consist of industrial and highrise buildings. There is no existing view to the San Francisco Bay along these streets.

The TTC pedestrian bridge over Beale Street would connect the TTC to property currently owned by Caltrans that would be developed as part of the Redevelopment Plan for the area, as described in Chapter 2 of the FEIS/EIR. The property along the east side of Beale would be transferred from Caltrans to the TJPA according to a Cooperative Agreement.[1] The property is zoned for public use. Future use of the property is planned to be for a building to accommodate egress stairs from the below-ground train box levels of the TTC and mechanical equipment to support the TTC. (*See* FEIS/EIR Addendum No. 1 p. 10 and Recommended Program Implementation Strategy, Transbay Joint Powers Authority, Feb. 10, 2006 (showing building on east of Beale)).

Under Urban Design Element Policy 2.10, release of street areas is permitted in the least extensive and least permanent manner appropriate. Here, only air rights are sought to be vacated for the proposed basket structures and pedestrian bridge, and surface streets would remain public ROW. Although the TJPA seeks to have the vacated properties conveyed in fee simple, this is appropriate given the long-term and public use of the property for the TTC.

The basket structures and pedestrian bridge are consistent with other General Plan Urban Design Policies. Existing street patterns will not be disrupted. The basket structures would add a design element that makes the TTC a more prominent center of activity. They will assist in distinctively identifying the TTC, making it easily understood and

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[1] State of California Department of Transportation District Agreement No. 4-1984-C (effective date July 11, 2003), City and County of San Francisco Resolution No. 441-03 (approved July 11, 2003), and Transbay Joint Powers Authority Board of Directors Resolution No. 03-004 (approved May 30, 2003).

remembered as a transit stop. The basket structures would not interfere with views downward to the proposed park from higher surrounding view points. See Section M, below, for additional discussion of the visual and aesthetic impacts of the basket structure. The pedestrian bridge would create a continuous design connection between the rooftop park and the adjacent property, providing additional access the park from the outside in addition to access from inside the TTC. The bridge will also provide an additional point from which to view the rooftop park and downtown.

The pedestrian bridge may have some adverse impacts, however these would not be significant. As discussed above, the pedestrian bridge's shadow impacts on the street will not be significant. The bridge will slightly clutter the air space surrounding the TTC and rooftop park. The existing conditions along this stretch of Beale Street, however, includes several overhead crossings. The existing bus ramps for the Transbay Terminal currently cross Beale Street in two locations, north and south of Howard Street. South of that, Harrison Street crosses over Beale. I-80 crosses over Beale Street south of Harrison Street. The existing bus ramps will be demolished during construction of the TTC. The proposed pedestrian bridge will allow for a lighter, more visually pleasing design than the existing bus ramps. In addition, the pedestrian bridge would be located approximately 65 feet above the street. Thus, pedestrians would still have relatively expansive views through the street beneath the bridge.

### B. Displacements and Relocations

The proposed public ROW vacations necessary for the basket structure and bridge over Beale Street would not divide an established community or conflict with applicable land uses plans, policies, or regulations, but would allow a portion of the building to overhang (but not obstruct) the sidewalk on Minna, Natoma, and Beale Streets. The City currently owns all property to be conveyed to the TJPA following the public ROW vacations. As noted above, property along the east side of Beale would be transferred from Caltrans to the TJPA according to a Cooperative Agreement.[2] The new design of the basket structure would continue along the entire side of the TTC connecting several blocks together in a cohesive fashion. The pedestrian bridge would also provide pedestrian circulation vertically and horizontally connecting the blocks and improving land use compatibility.

### C. Socio-economics

The beneficial socio-economic impacts resulting from the increased activity and economic vitality generated by the project would remain as described in the FEIS/EIR (p. 5-35).

### D. Community Facilities and Services/Safety and Security

The public ROW vacation process during TTC construction would comply with FEIS/EIR mitigation, which includes, but is not limited, to a combination of construction contract specifications, drawings, and provisions, as well as public affairs and a public construction coordination programs (FEIS/EIR pp. 5-198 to 200). The vacation has been

[2] State of California Department of Transportation District Agreement No. 4-1984-C effective date July 11, 2003, City and County of San Francisco Resolution No. 441-03 approved July 11, 2003, and Transbay Joint Powers Authority Board of Directors Resolution No. 03-004 signed May 30, 2003.

designed to reduce impacts to area businesses and property owners, and so that project mitigation would best meet community needs. Construction within the vacated areas would comply with the Safety and Security guidelines in the FEIS/EIR (pp. 5-122 and 5-225). The additional construction activities, which represent a small portion of the entire TTC construction effort, would not require additional staff or public service capacity to respond to emergencies in the area.

### E. Parklands/Schools/Religious Institutions

Public ROW vacations would not alter the finding in the FEIS/EIR (pp. 5-44, 5-45, and 5-204) that the project would not produce adverse impacts to parks, schools, and religious institutions, since none of these uses are located in the immediate vicinity of the vacations identified. The project includes additional park space that can be accessed by the public.

### F. Air Quality

Construction of the Beale Street pedestrian bridge and the basket structures would result in no change to potential air quality impacts previously evaluated in the FEIS/EIR. As stated on page 5-205 of the FEIS/EIR, there are no quantitative emissions thresholds for construction activities, which are by their nature temporary and occur over a large area, potentially affecting different receptors at different times. The project would comply with the Bay Area Air Quality Management District's (BAAQMD) approach to the analysis of construction impacts through the implementation of control measures. The public ROW vacations and construction of the Beale Street bridge would comply with measures listed on pages 5-205 and 5-206 of the Final EIS/EIR, which includes but is not limited to watering all active construction areas at least twice daily; covering all trucks hauling soil, sand, and other loose materials or requiring all trucks to maintain at least two feet of freeboard; and sweeping daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites.

### G. Noise and Vibration

Construction of the baskets and Beale Street bridge would not result in new significant or substantially increased operational impacts to noise or vibration levels. Construction would be conducted in compliance with previously adopted FEIS/EIR Mitigation Measures NoiC 1 to NoiC 6, which would reduce impacts to less than significant.

### H. Geology and Seismology

The TTC has been designed with pile supported foundations sufficient to support all functions (FEIS/EIR pp. 5-79 to 5-80, 5-225). The new basket-like curtain wall structure would be designed to connect into the existing superstructure intended to support the TTC. The design elements would be evaluated along with the entire structure to conform to required code standards for seismicity. Structural components of the project would be designed and constructed to resist strong ground motions approximating the maximum anticipated earthquake (0.5g) (FEIS/EIR p. 5-80). As identified in the FEIS/EIR, supports would serve to minimize settlement and lateral displacement resulting from seismic shaking (FEIS/EIR p. 5-80). The Beale Street bridge would be designed to the same construction standards identified in the FEIS/EIR for the TTC. Therefore no additional

significant impacts are anticipated due to geology or soils than those previously evaluated.

### I. Water Resources and Floodplains

No long-term adverse impacts on water resources and floodplains were identified in the FEIS/EIR. The limited area affected by construction activities for the Beale Street bridge would not change the risk of impact to water resources or floodplains from that described in the FEIS/EIR (p. 5-80).

### J. Utilities and Energy

As discussed in the FEIS/EIR, the Transbay Terminal/Caltrain Downtown Extension/ Redevelopment Project would result in an increase in demand for and use of water and energy, but not in excess of amounts expected and provided for in the area (FEIS/EIR p. 5-81). The Beale Street bridge and basket construction activities would require minor amounts of water and energy, as compared to the project, and operation would not require additional sources beyond those previously evaluated in the project's environmental documents. As identified on page 2-11 of the FEIS/EIR, design of the terminal would incorporate sustainable features that would allow the building to use site-specific wind, daylight and shading to reduce the building's energy needs. The basket structures would allow for the passage of more light through the TTC. The use of more translucent materials would provide transparency during the day and at night. The additional light that would filter into the space during the day would reduce energy needs.

### K. Historic and Cultural Resources

The public ROW vacation above ground would occur in air space above street level and would not impact historical resources in the area. The new design of the elevation consisting of a basket-like structure will provide a modern style of architecture that is not currently represented in the area. However, the TTC design modifications do not significantly change the impacts already analyzed in the FEIS/EIR as the features described in this addendum would remain visually cohesive with the area, and analysis of impacts to historic districts and resources, as evaluated on pages 5-112, 5-116, and 5-117, would be consistent with current design proposals. The transparency of the design would allow for views through the space reducing the visual obstruction of existing historic architecture in the vicinity, a beneficial effect. Historic properties are not located on the east side of Beale Street where the pedestrian bridge would extend over Beale Street. Although, below ground construction associated with public ROW vacation and construction of the Beale Street bridge may not result in new or more severe impacts to cultural resources, it has the potential to impact unknown cultural resources. TTC construction activities would comply with previously adopted mitigation as indicated in the Memorandum of Agreement between the local and federal lead agencies and the State Historic Preservation Officer (FEIS/EIR Appendix G), and potential impacts would be less than significant (FEIS/EIR pp. 5-86 to 5-90, 5-216, and Appendix G).

### L. Hazardous Materials

If hazardous materials are encountered during utility relocation for public ROW vacation, they would be handled as indicated in the FEIS/EIR (pp. 5-222 to 5-224).

### M. Visual and Aesthetic

Design of the TTC elevation now proposes an organic basket-like structure with an undulating appearance that alternates between concave and convex curves, suspended over the side walk. This specific design feature would provide more visual interest along the street and would not result in a more severe impact to the existing visual character of the site than previously evaluated in the FEIS/EIR.

The new curved design of the basket structure would be constructed of materials allowing for better transparency when compared to the design originally analyzed in the FEIS/EIR. This will allow for the passage of daylight into the space on the concourse and bus levels during the daytime and the illumination of inside light onto the street during the nighttime when the TTC is operating. The new design would enhance views into the TTC space from the street so that functions and activities would be identifiable and easier to locate. The transparency of the structure would also allow for more continuous views outward for users of the TTC. The basket structure would be suspended over the sidewalk creating an overhead covering, providing a translucent quality that would allow for light to filter down to the street level.

View corridors along the street would be interrupted at First and Fremont Streets where bridge portions would cross over the streets. This would alter the public view at the ground level to some extent; however, the structure would frame views down the street and views to the north and south are still possible. The view obstruction looking upward from the street would not be substantial, and this impact would not be considered significant. Additionally, the new transparent design would allow for some views through the structure. The new design would enhance the pedestrian visual experience at the roof park and bridge levels over the street. Views at this height would be provided in multiple directions that are not currently achievable from the street level.

The design modification impacts from above ground light and glare would be within the envelope of those previously evaluated by the FEIS/EIR as the materials and equipment to be used are anticipated to be similar to those previously analyzed. Construction-related light and glare would be consistent with FEIS/EIR findings that construction would generate additional night lighting but not in amount unusual for a transportation hub in a developed urban area (FEIS/EIR p. 5-120). Short-term visual changes as a result of temporary construction activities are common and accepted elements in the redevelopment area; therefore mitigation is not required (FEIS/EIR p. 5-224). However, as addressed in the FEIS/EIR, TJPA would require project contractors to ensure that at night artificial lightings would be directed to minimize "spill over" light or glare effects.

Once the project is complete, the new TTC design modifications would allow for the passage of more light through the TTC. The use of translucent materials would provide transparency during the day and at night. During the nighttime, the lighting on the

interior would provide some illumination that would also filter onto the street. This would provide a level of light similar to street lamps. Lighting would be designed to limit glare and reflectance upon surfaces to reduce any potential negative effect to users in the vicinity.

See Section A, above, for additional discussion of visual and aesthetic impacts of the pedestrian bridge over Beale Street.

### N. Transportation

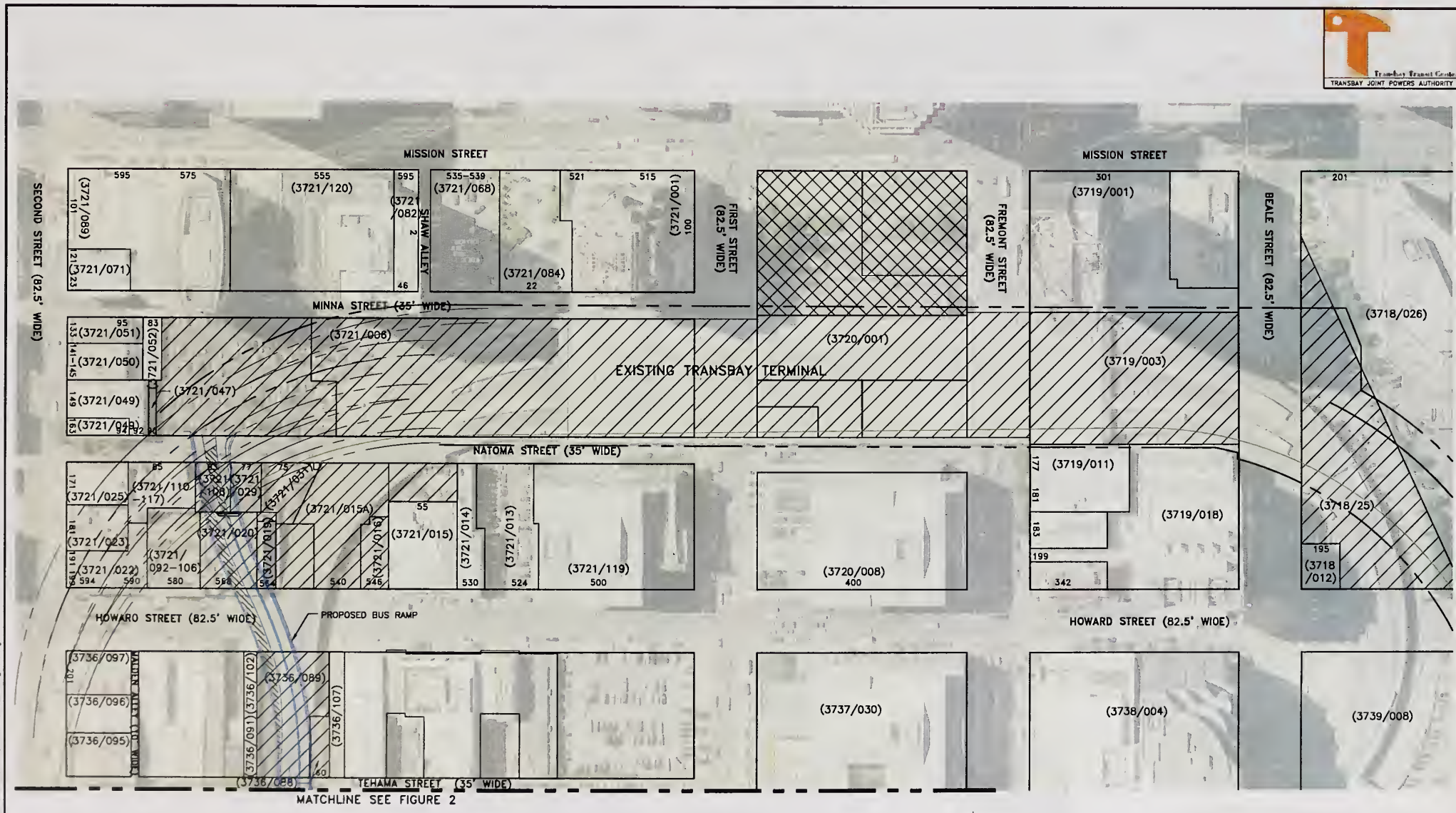
Construction activities would not impact area traffic with the exception of altering lane configuration during utility relocating or construction of the bridge over Beale Street. The FEIS/EIR previously identified Natoma Street between First and Second Streets; Minna Street between First and Second Streets; and First, Fremont, and Beale Streets between Howard and Mission Streets for street closures during construction (FEIS/EIR pp. 5-160 to 5-161). The construction in vacated areas would comply with FEIS/EIR mitigation which includes, but is not limited to a combination of construction contract specification, drawings, and provisions, as well as public affairs programs. Public ROW vacation would not result in new or additional impacts to transportation as previously identified by the FEIS/EIR.

## VII. ENVIRONMENTAL FINDINGS

Based on the above information and analysis, the proposed public ROW vacations for the Transit Center and its design modifications will not trigger the need for subsequent environmental review pursuant to Public Resources Code section 21166 and sections 15162 and 15163 of the CEQA guidelines. The proposed public ROW vacations described in this addendum would not require major revisions to the FEIS/EIR due to new or substantially increased significant environmental effects. Furthermore, there have been no substantial changes with respect to the circumstances under which the public ROW vacations would be undertaken that would require major revisions of the FEIS/EIR due to new or substantially increased significant environmental effects; and there has been no discovery of new information of substantial importance that would trigger or require major revisions to the FEIS/EIR due to new or substantially increased significant environmental effects. Therefore, no subsequent or supplemental environmental impact report is required prior to approval of the public ROW vacations for the Transit Center and its design modifications as described in this addendum.

**Figure 1**

Bus Level
Retail / Office Mezzanine
Ground Level
Grand Concourse




LEGEND

PHASE 1 PROPERTIES NOTED IN FEIS/EIR FOR TJPA ACQUISITION

FUTURE TRANSIT TOWER SITE

0 30 60 120 180

SCALE IN FEET

PUBLIC RIGHT-OF-WAY VACATION (ROW)
TRANSIT CENTER (TC)
AERIAL PHOTO, JULY 2008

TRANSBAY TRANSIT CENTER PROJECT
SAN FRANCISCO, CALIFORNIA

APRIL 2009

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FIGURE 1

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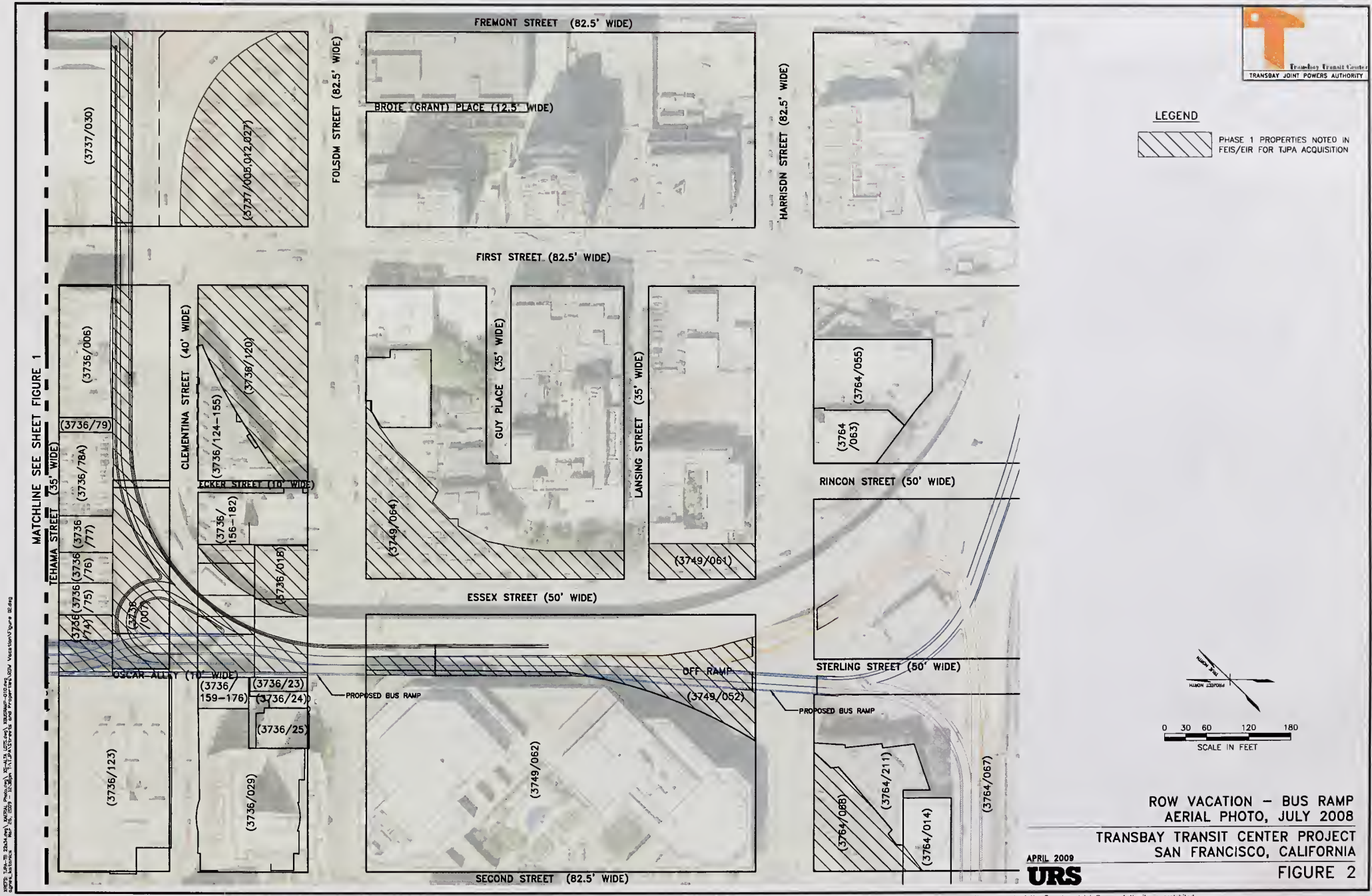


Transbay Transit Center
TRANSBAY JOINT POWERS AUTHORITY

LEGEND

PHASE 1 PROPERTIES NOTED IN FEIS/EIR FOR TJPA ACQUISITION

PROJECT NORTH

0 30 60 120 180
SCALE IN FEET

ROW VACATION – BUS RAMP
AERIAL PHOTO, JULY 2008

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FIGURE 2

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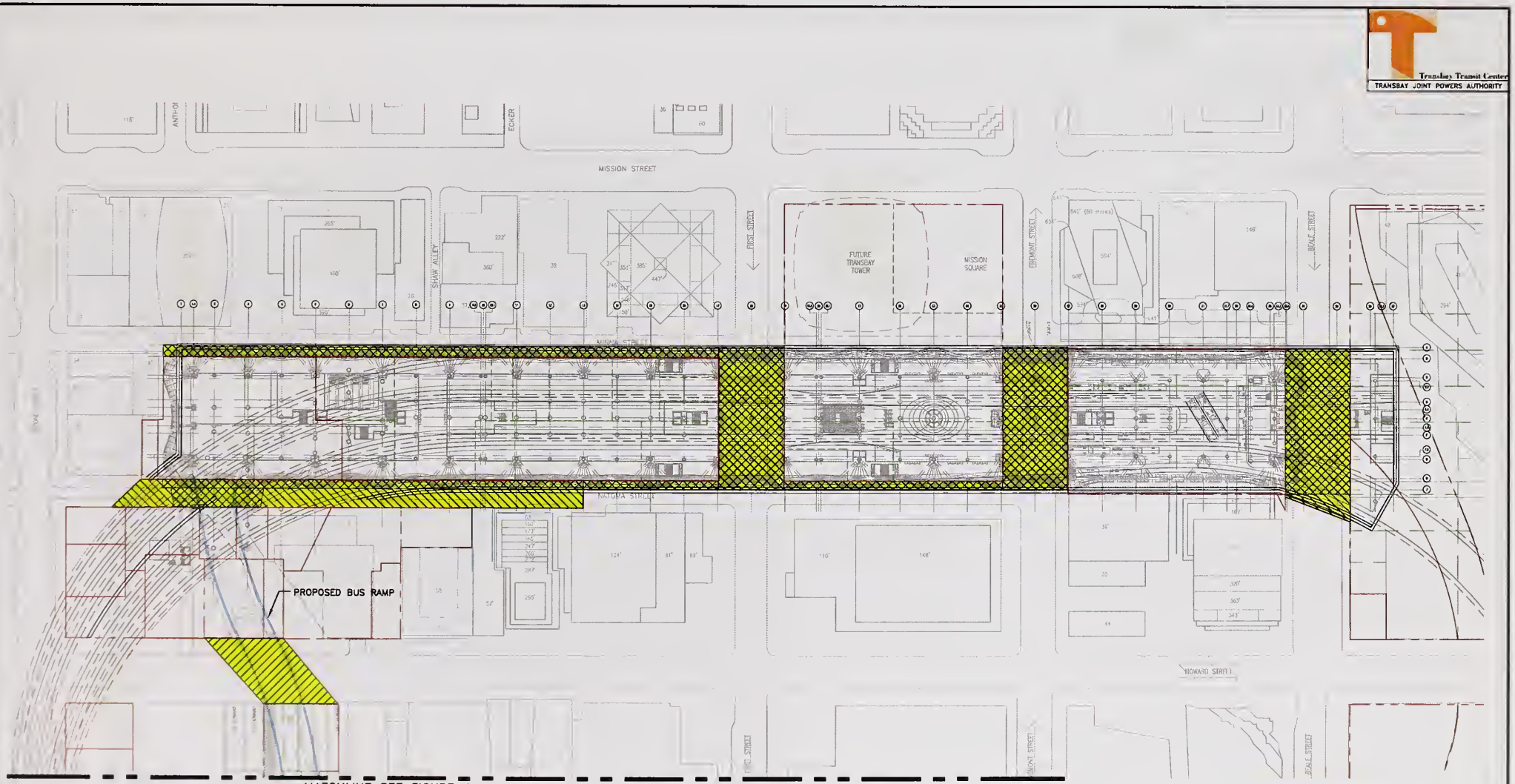


ROW VACATION
TRANSIT CENTER

TRANSBAY TRANSIT CENTER PROJECT
SAN FRANCISCO, CALIFORNIA

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FIGURE 3

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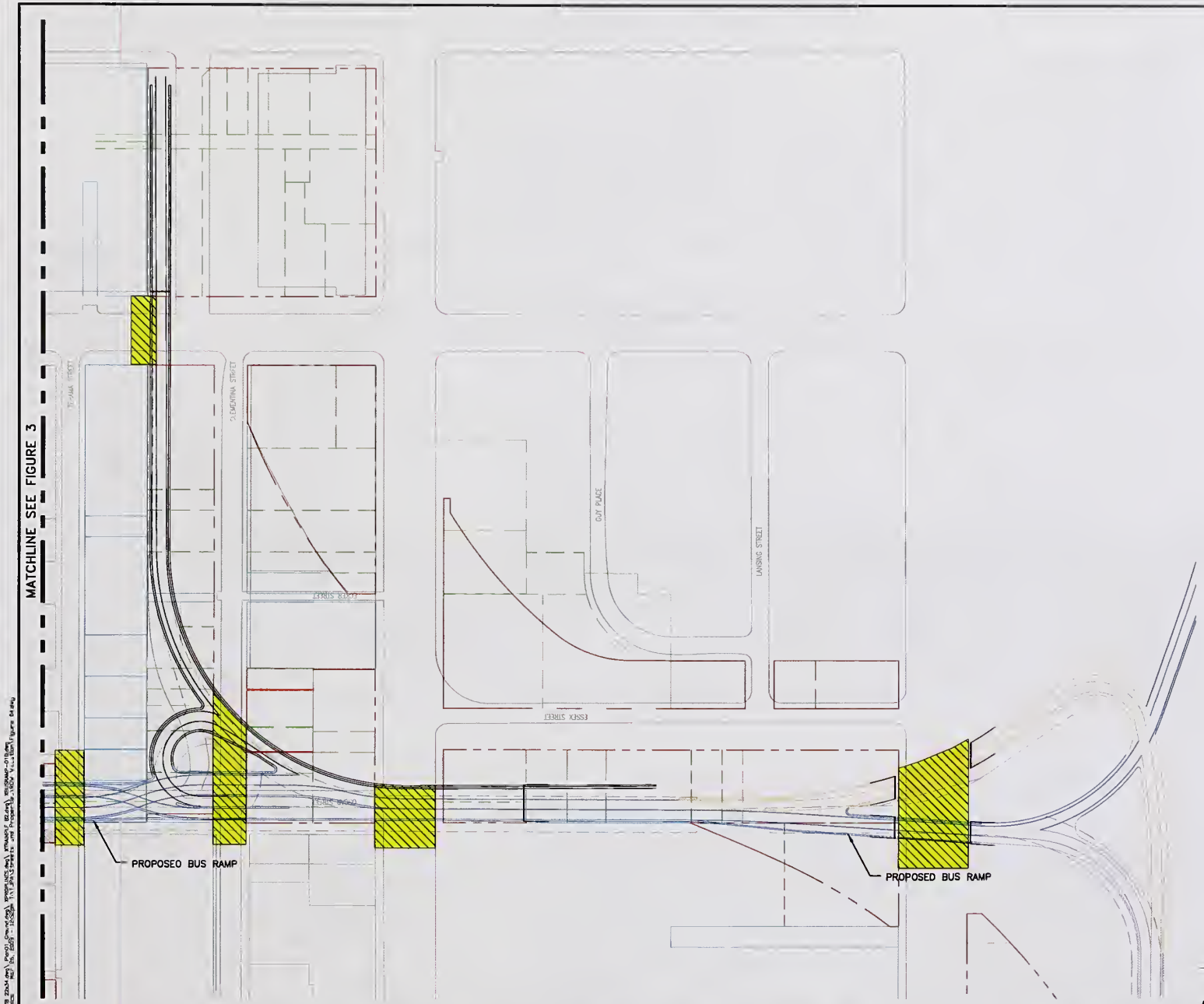


Transbay Transit Center
TRANSBAY JOINT POWERS AUTHORITY

LEGEND

ABOVE STREET REQUESTED VACATION

PROJECT NORTH
TRUE NORTH

0 30 60 120 180
SCALE IN FEET

ROW VACATION
BUS RAMP

TRANSBAY TRANSIT CENTER PROJECT
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FIGURE 4

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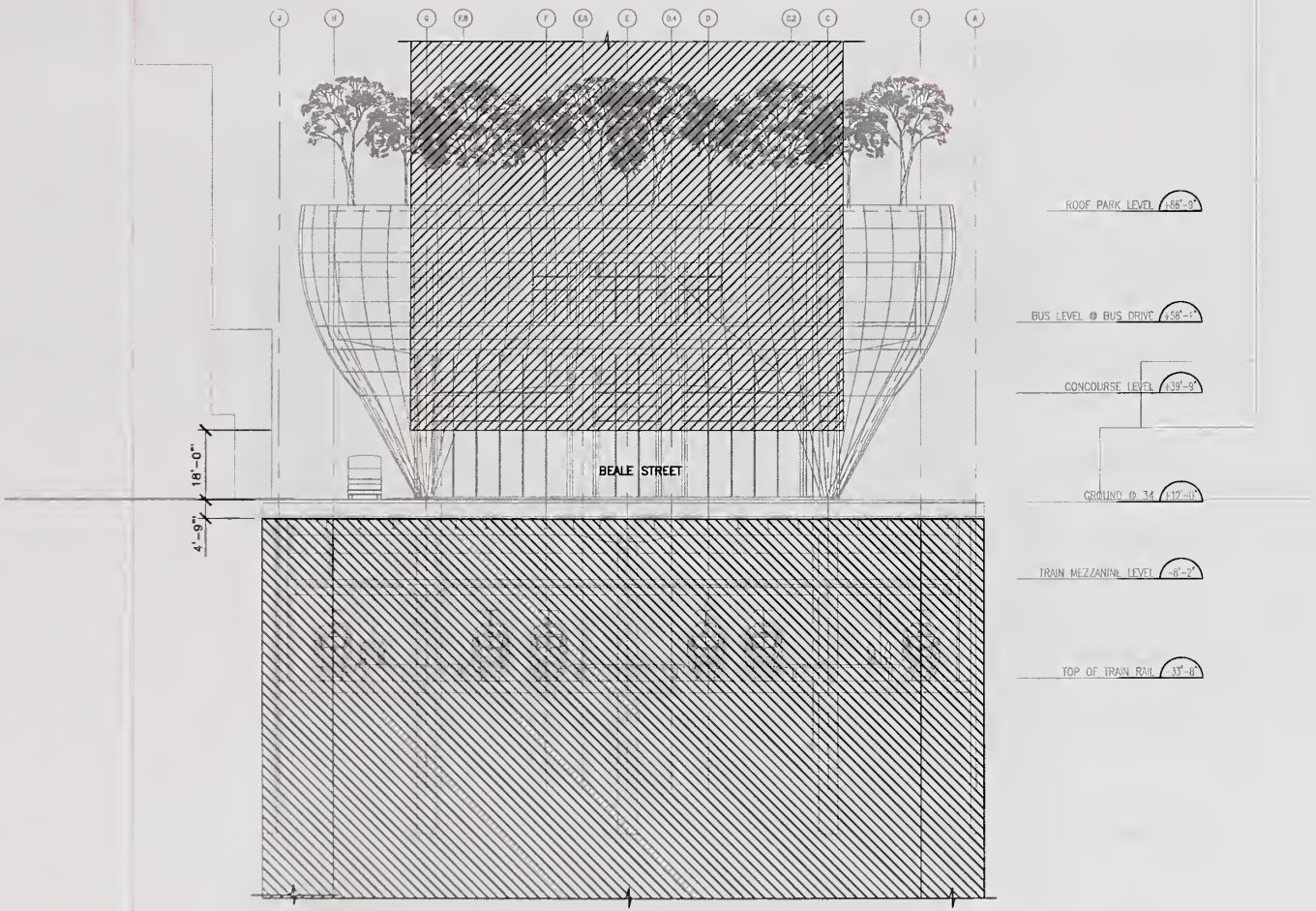


LOOKING WEST

SECTION AT BEALE STREET

SCALE: 1/16"=1'-0"

LEGEND

ABOVE STREET REQUESTED VACATION

BELOW STREET REQUESTED VACATION

0 8 16 32 48

SCALE IN FEET

Transbay Transit Center

TRANSBAY JOINT POWERS AUTHORITY

ROW VACATION

BEALE STREET BRIDGE

TRANSBAY TRANSIT CENTER PROJECT

SAN FRANCISCO, CALIFORNIA

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FIGURE 5

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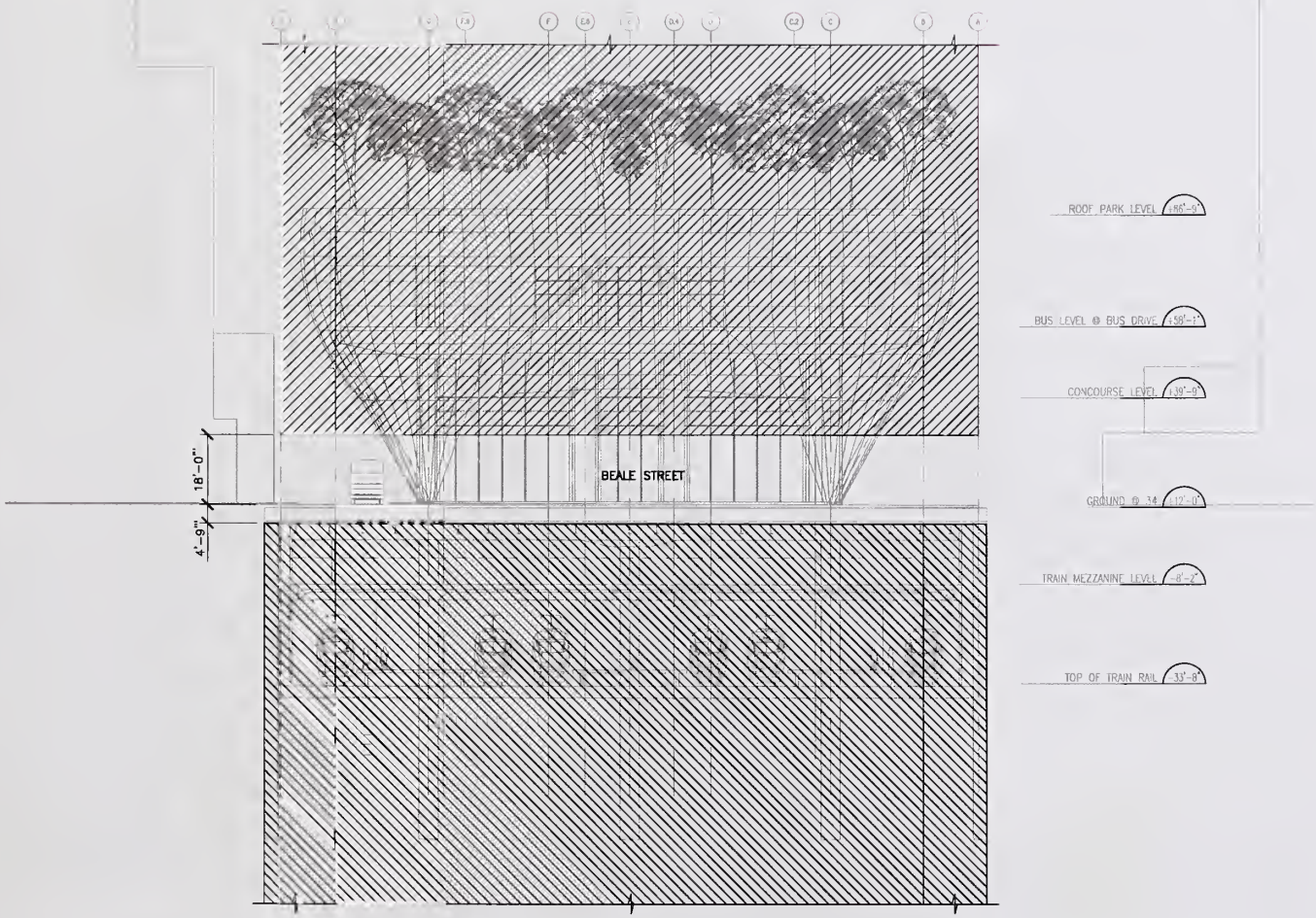


LOOKING WEST
SECTION AT BEALE STREET
SCALE: 1/16"=1'-0"

LEGEND

ABOVE STREET REQUESTED VACATION

BELOW STREET REQUESTED VACATION

0 8 16 32 48
SCALE IN FEET

ROW VACATION
BEALE STREET
TRANSBAY TRANSIT CENTER PROJECT
SAN FRANCISCO, CALIFORNIA
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FIGURE 6

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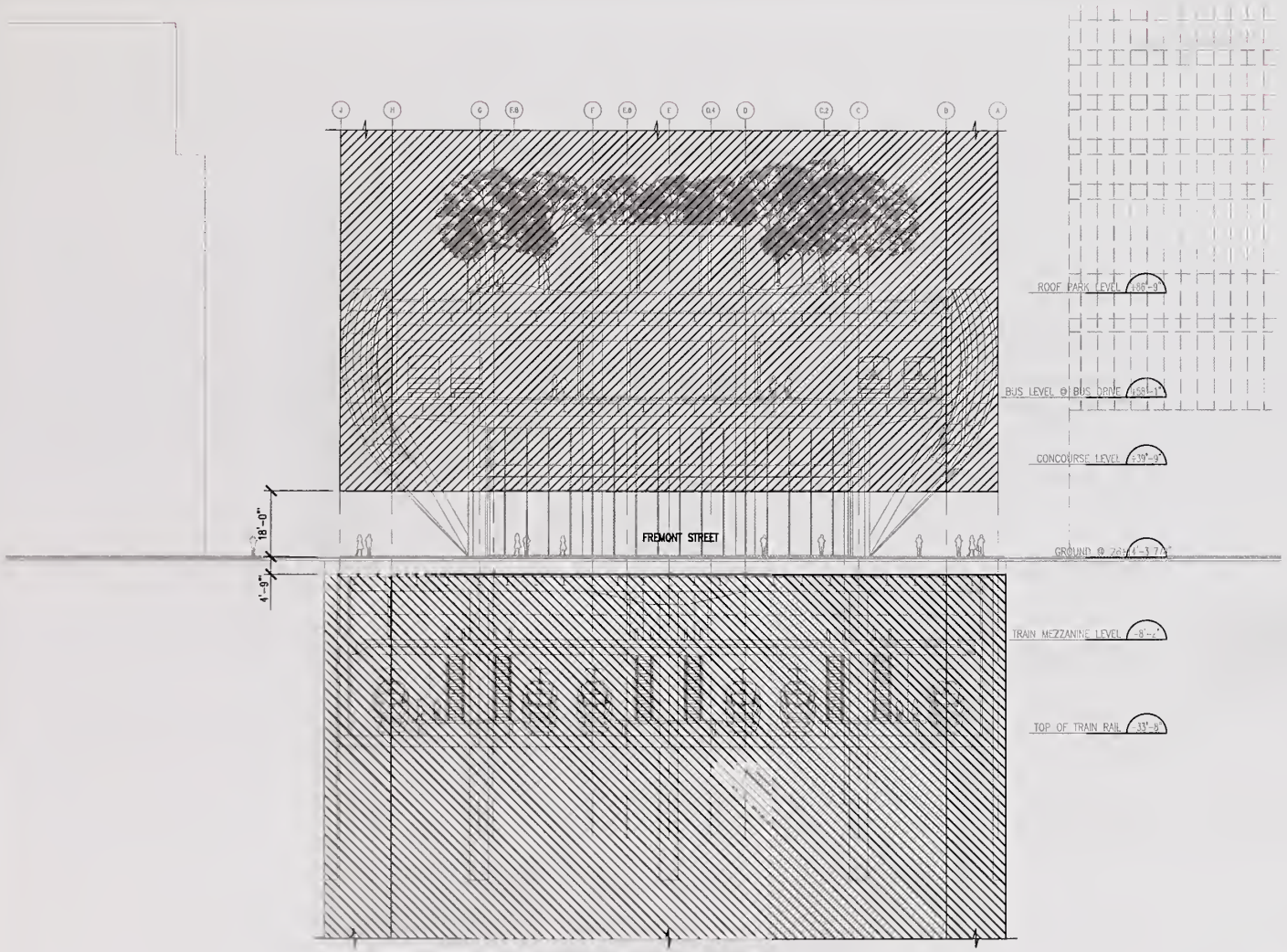


LOOKING WEST

SECTION AT FREMONT STREET

SCALE: 1/16"=1'-0"

LEGEND

ABOVE STREET REQUESTED VACATION

BELOW STREET REQUESTED VACATION

0 8 16 32 48

SCALE IN FEET

Transbay Transit Center

TRANSBAY JOINT POWERS AUTHORITY

ROW VACATION
FREMONT STREET

TRANSBAY TRANSIT CENTER PROJECT
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FIGURE 7

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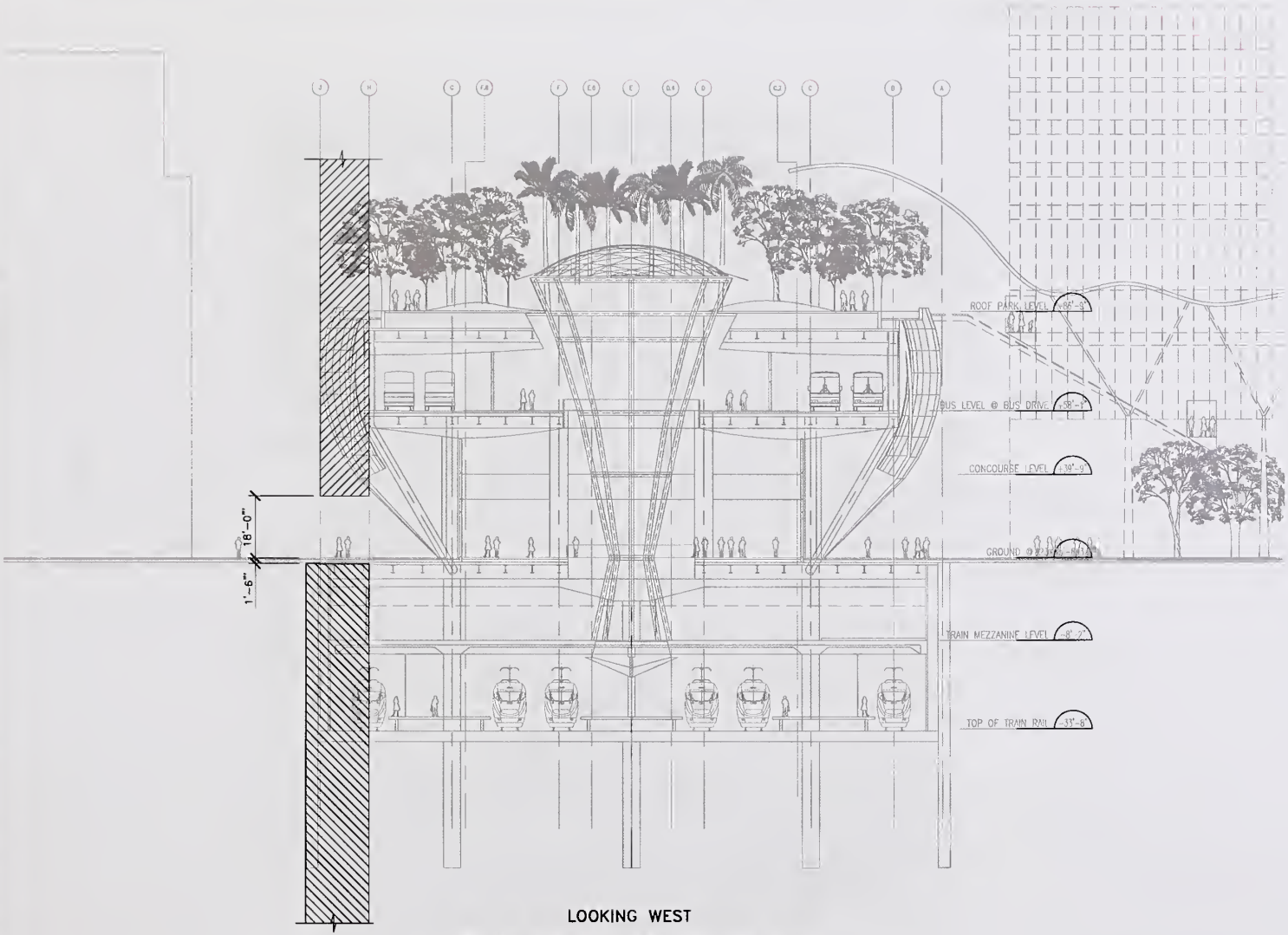
Transbay Transit Center
TRANSBAY JOINT POWERS AUTHORITY




LOOKING WEST

SECTION BETWEEN FREMONT AND FIRST STREET
SCALE: 1/16" = 1'-0"

LEGEND

ABOVE STREET REQUESTED VACATION

BELOW STREET REQUESTED VACATION

0 8 16 32 48
SCALE IN FEET

ROW VACATION
BETWEEN FREMONT AND FIRST STREET
TRANSBAY TRANSIT CENTER PROJECT
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FIGURE 8

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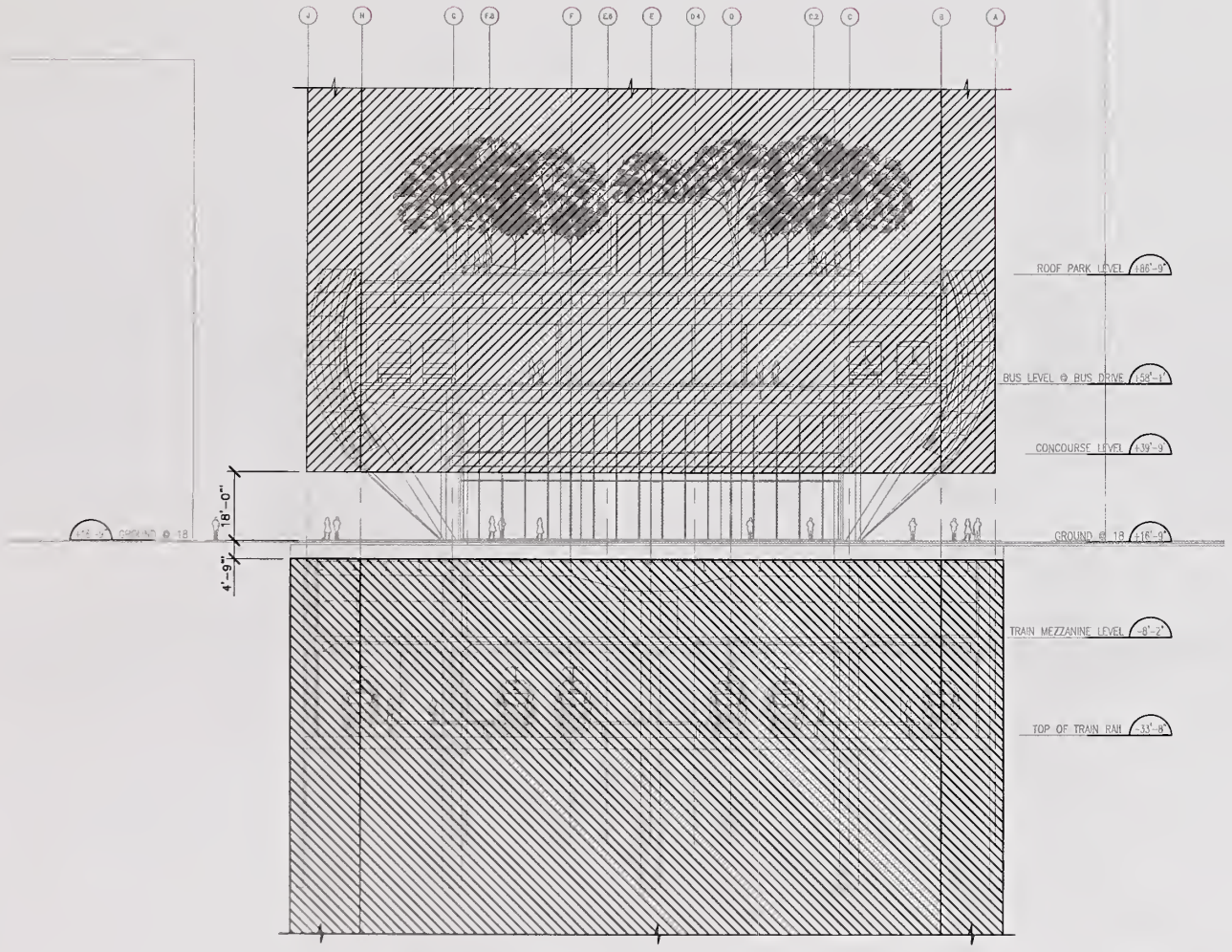


LOOKING WEST

SECTION AT FIRST STREET

SCALE: 1/16"=1'-0"

0 8 16 32 48

SCALE IN FEET

LEGEND

ABOVE STREET REQUESTED VACATION

BELOW STREET REQUESTED VACATION

Transbay Transit Center

TRANSBAY JOINT POWERS AUTHORITY

ROW VACATION
FIRST STREET

TRANSBAY TRANSIT CENTER PROJECT
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FIGURE 9

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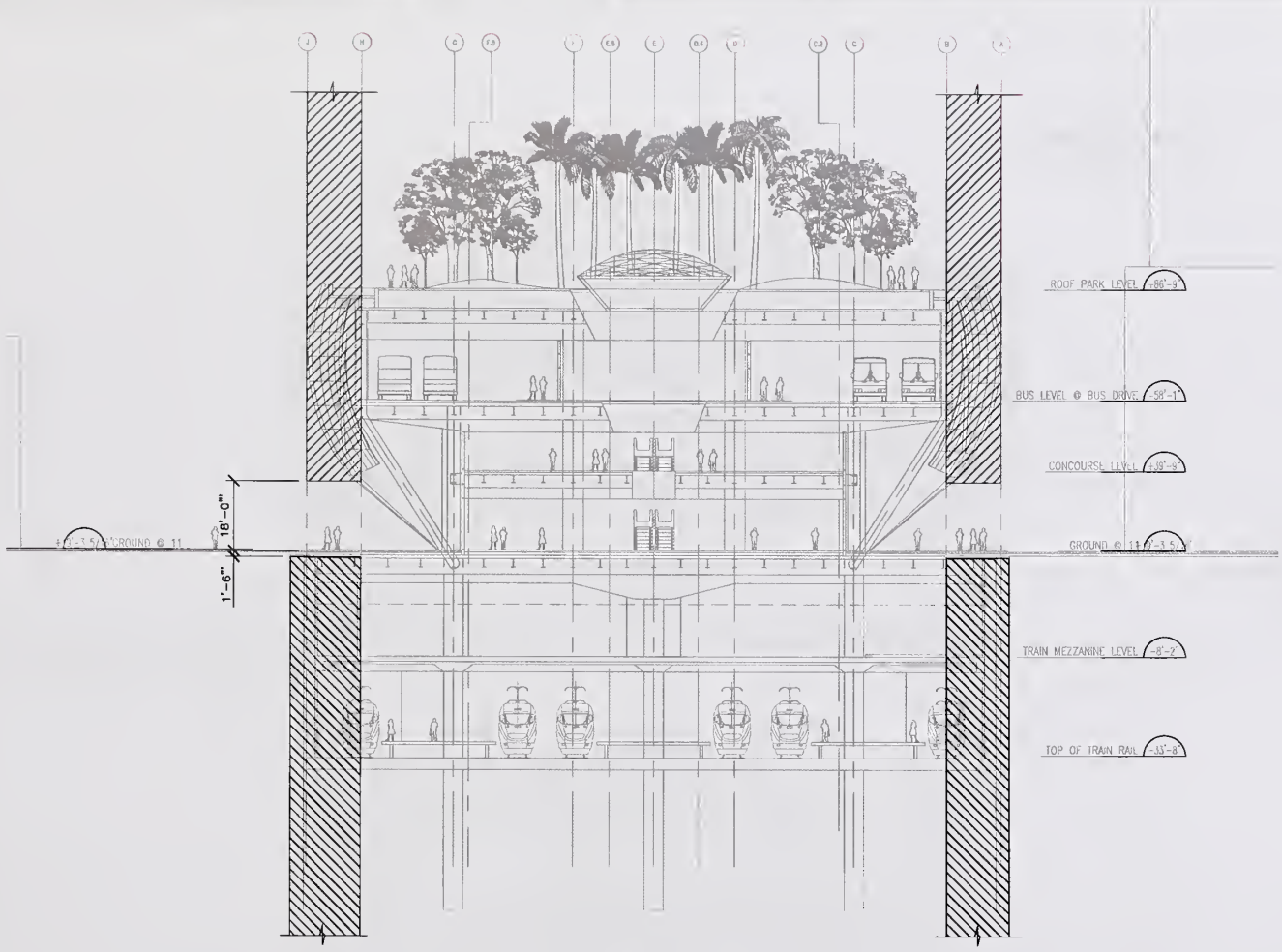


LOOKING WEST

SECTION – WEST OF FIRST STREET
SCALE: 1/16"=1'-0"

0 8 16 32 48
SCALE IN FEET

LEGEND

ABOVE STREET REQUESTED VACATION

BELOW STREET REQUESTED VACATION

Transbay Transit Center
TRANSBAY JOINT POWERS AUTHORITY

ROW VACATION
WEST OF FIRST STREET
TRANSBAY TRANSIT CENTER PROJECT
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FIGURE 10

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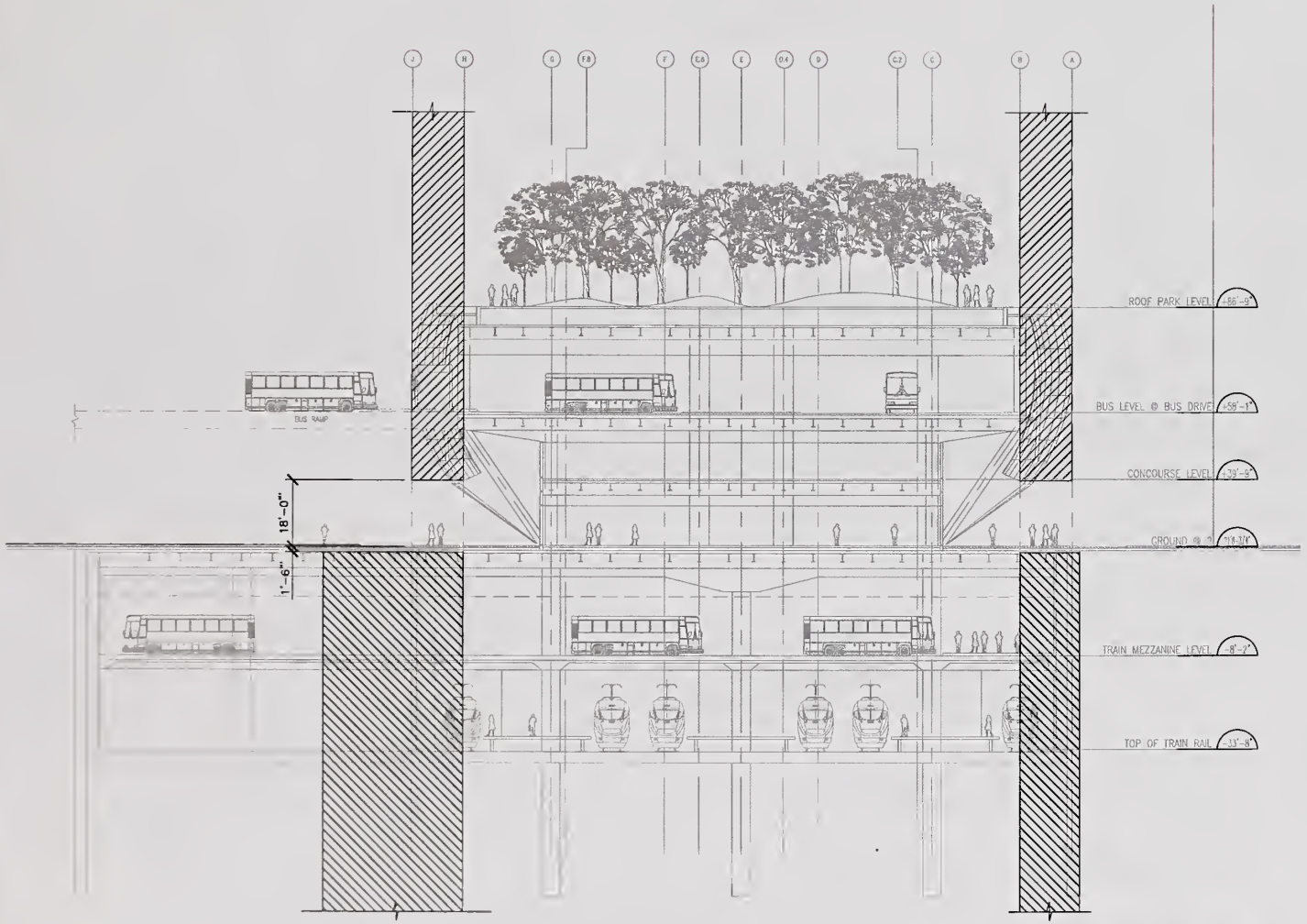


LOOKING WEST

SECTION AT WEST END

SCALE: 1/16"=1'-0"

0 8 16 32 48

SCALE IN FEET

LEGEND

ABOVE STREET REQUESTED VACATION

BELOW STREET REQUESTED VACATION

Transbay Transit Center

TRANSBAY JOINT POWERS AUTHORITY

ROW VACATION
WEST END

TRANSBAY TRANSIT CENTER PROJECT
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FIGURE 11

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Exhibit 6a & b

# Memorandum

U.S Department
of Transportation
**Federal Transit**
**Administration**

Subject: Environmental Clearance for advance construction of "train box" portion of Transbay Transit Center

Date: August 13, 2009

From: Leslie T. Rogers
Regional Administrator

Reply to
Attn of: Eric Eidlin, Community Planner

To: Paula Schwach
TIFIA JPO Counsel

You have asked the FTA Region IX office to determine whether the accelerated construction of the "train box" portion of the Transbay Transit Center would require additional environmental review After careful review of the March 2004 FEIS and associated ROD for the Transbay Terminal / Caltrain Downtown Extension / Redevelopment Project, dated February 5, 2005, Region IX concludes that building the Transit Center in one single longer phase, as opposed to two phases, was already analyzed in the FEIS As such, no additional environmental review should be required, unless new information surfaces that new or more severe impacts on the environment would result from the advance construction of the train box.

We should also note that major actions to advance the project, such as the demolition of the old terminal, have been underway since the ROD was signed in 2005, so a re-evaluation of the FEIS due to the passage of time is not required.

There has been some confusion about whether the analysis conducted for the March 2004 FEIS would cover the advance construction of the train box because of two primary reasons:

1. **Project Phasing and the Removal of Excavation Spoils**
   The Transbay Joint Powers Authority (TJPA) made changes to the construction phasing plan that was proposed in the FEIS for the project, changes that TJPA has since reconsidered.

2. **California High Speed Rail Authority's New Design Criteria**
   The California High Speed Rail Authority (CHSRA) and the Peninsula Corridor Joint Powers Board (Caltrain) announced new design requirements for the Transit Center in January 2009 that could have significantly increased the size, scope and cost of the project However, since that time, technical staff of TJPA, CHSRA, and Caltrain have agreed that the current design of the train box will meet near-term ridership demand and operating requirements. Overflow from the Transbay Transit Center, which is not expected, if at all, until many years in the future, would be accommodated by a redesigned 4th and King Streets Station.

These issues are discussed in greater detail below.

**Project Phasing and the Removal of Excavation Spoils**
The TJPA Board of Directors approved a two-step phasing plan for the project in February 2006, one year after the FTA issued the ROD for the project. In that phasing plan, TJPA envisioned constructing the train box portion of the Transit Center after the Caltrain Downtown Extension Tunnel. By completing the tunnel prior to construction of the train box, the tunnel could have been used to convey excavation spoils from the Transit Center underground to the Caltrain Yard at 4th and King, the transfer point where all spoils from the project will be loaded onto trains for disposal out of the area. Phasing construction in this way would have significantly reduced the volume of construction-related truck traffic on roadways surrounding the Transit Center.

However, at the time of the publication of the FEIS, TJPA assumed that construction of the Transit Center would occur in a single phase, and the project alternative analyzed in the FEIS represented the "worst case" scenario in terms of construction impacts. In this "worst case" scenario, the FEIS assumed that all construction-related debris from the Transit Center would be hauled by truck to the Caltrain Yard on local streets (see FEIS, pp. 192-193). In light of the above, Region IX believes that advance construction of the train box would not result in environmental impacts beyond those already analyzed in the FEIS, and that no additional environmental review should be required.

**California High Speed Rail Authority's New Design Criteria**
In January 2009, CHSRA and Caltrain raised concerns about the ability of the train box to meet the physical requirements and operating needs of their systems. Specifically, CHSRA asserted that the Transit Center would need to be designed to accommodate 12 trains per hour. This level of service would require 8-10 tracks, rather than the 6 tracks analyzed in the FEIS/EIR, and would necessitate the construction of one additional underground platform level. Including the train mezzanine, this would mean a total of three levels below ground rather than the two levels analyzed in the FEIS/EIR.

As currently designed, the train box will have 4 tracks and platforms dedicated to high speed rail, accommodating 6-8 trains per hour. After thorough review and discussion, TJPA, CHSRA and Caltrain staff agreed that the current design of the train box will meet near-term ridership demand and operating requirements. Overflow from the Transbay Transit Center, which is not expected, if at all, until many years in the future, would be accommodated by a redesigned 4th and King Streets Station. Since TJPA is not planning to alter the design of the Transit Center in response to the recent CHSRA/Caltrain request, no additional environmental review is warranted.

If you have any questions or comments regarding this memo, please contact Eric Eidlin, FTA Community Planner, at (415) 744-2502 or Eric.Eidlin@dot.gov.

cc by e-mail:
Cheryl Jones, Senior Project Finance Advisor, TIFIA JPO
Jorianne Jernberg, Federal Transit Administration Liaison to the TIFIA JPO
Joe Ossi, Federal Transit Administration Office of Planning and the Environment

U.S. Department
of Transportation

**Federal Railroad
Administration**

**Deputy Administrator**

1200 New Jersey Avenue, SE
Washington, DC 20590

MAR 2 9 2010

Ms. Maria Ayerdi-Kaplan
Executive Director
Transbay Joint Powers Authority
201 Mission Street #2100
San Francisco, California 94105

Dear Ms. Ayerdi-Kaplan:

I write to confirm that Secretary LaHood has reserved funds within the overall California allocation of the Department's High Speed Rail grants to provide funding for design and construction of the Transbay Terminal project. The California allocation will be sufficient to provide up to $400 million to the Transbay Joint Powers Authority (TJPA) for eligible elements of the Transbay Terminal project, subject to completion of the applicable regulatory clearances.

I greatly appreciate the cooperation you are providing us by making your staff and contractors available to assist in our environmental work. I believe that will help to minimize administrative delays and allow construction of the Transbay Terminal project to begin as soon as possible.

Best Regards,

Karen Rae
Deputy Administrator

Exhibit 7

# Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project
# FEIS/FEIR Mitigation Monitoring and Reporting Program

**UPDATED MITIGATION MEASURES PRESENTED AND ANALYZED IN FINAL EIS/EIR AS ADOPTED**

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## 1. WIND

See discussion of wind impacts in Section 5.1.2 of the Final EIS/EIR. Mitigation measures include:

**W 1** – The San Francisco Redevelopment Agency (Agency) shall consider potential wind effects of an individual project for the Redevelopment area. If necessary, perform wind tunnel testing in accordance with City Planning Code Section 148. If exceedences of the wind hazard criterion should occur for any individual project, require design modifications or other mitigation measures to mitigate or eliminate these exceedences. Tailor mitigation measures to the individual needs of each project. Examples of mitigation measures include articulation of building sides and softening of sharp building edges.

## 2. PROPERTY ACQUISITION/RELOCATION

See discussion of property acquisition impacts, Section 5.2 of the Final EIS/EIR. Mitigation measures include:

**Prop 1** – TJPA shall apply federal Uniform Relocation Act (Public Law 91-646) and California Relocation Act (Chapter 16, Section 7260 et seq. of the Government Code) and related laws and regulations governing both land acquisition and relocation. All real property to be acquired will be appraised to determine its fair market value before an offer is made to each property owner. (Minimum relocation payments are detailed in the laws, and include moving and search payments for businesses.) Provide information, assistance, and payments to all displaced businesses in accordance with these laws and regulations.

## 3. SAFETY AND EMERGENCY SERVICES

See discussion of safety and emergency services, Section 5.4 of the Final EIS/EIR. Mitigation measures include:

**Saf 1** – TJPA shall provide Project plans to the San Francisco Fire Department for its review to ensure that adequate life safety measures and emergency access are incorporated into the design and construction of Project facilities.

**Saf 2** – TJPA shall prepare a life safety plan including the provision of on-site measures such as a fire command post at the Terminal, the Fire Department's 800-megahertz radio system and all necessary fire suppression equipment.

**Saf 3** – TJPA shall prepare a risk analysis to accurately determine the number of personnel necessary to maintain an acceptable level of service at Project facilities.

## 4. NOISE – OPERATIONS

See discussion of noise impacts, Section 5.8 of the Final EIS/EIR. Mitigation measures include:

**NoiO 1** – TJPA shall apply noise mitigation at the following locations adjacent to the bus storage facility:

- Provide sound insulation to mitigate noise impacts at the residences north of the AC Transit Facility at the corner of Perry and Third Street. At a minimum, apply sound insulation to the façade facing the bus storage facility (the south façade).
- Construct two noise barriers to mitigate noise impacts to Residences south of the AC Transit Facility along Stillman Street. The first noise barrier would be approximately 10-12 feet high and run along the southern edge of the AC Transit storage facility. The second noise barrier would be approximately 5-6 feet high and would be located on the portion of the ramp at the southwestern corner of the AC Transit facility. Treat the noise barriers with an absorptive material on the side facing the facility to minimize the potential for reflections off the underside of the freeway.
- Construct a noise barrier to mitigate noise impacts to residences south of the Golden Gate Transit Facility along Stillman Street. The barrier would be approximately 10-12 feet high and run along the southern and a portion of the eastern edge of the Golden Gate Transit storage facility. Treat the noise barriers with an absorptive material on the side facing the facility to minimize the potential for reflections off the underside of the freeway.

**NoiO 2** – TJPA shall landscape the noise walls. Develop the actual design of the walls in cooperation with area residents.

**NoiO 3** – TJPA shall construct noise walls prior to the development of the permanent bus facilities.

**5. NOISE – CONSTRUCTION**

See discussion of construction noise impacts, Section 5.21.10 of the Final EIS/EIR. Mitigation measures include:

**NoiC 1** – TJPA shall comply with San Francisco noise ordinance. The noise ordinance includes specific limits on noise from construction. The basic requirements are:

- Maximum noise level from any piece of powered construction equipment is limited to 80 dBA at 100 ft. This translates to 86 dBA at 50 feet.
- Impact tools are exempted, although such equipment must be equipped with effective mufflers and shields. The noise control equipment on impact tools must be as recommended by the manufacturer and approved by the Director of Public Works.
- Construction activity is prohibited between 8 p.m. and 7 a.m. if it causes noise that exceeds the ambient noise plus 5 dBA.

The noise ordinance is enforced by the San Francisco DPW, which may waive some of the noise requirements to expedite the Project or minimize traffic impacts. For example, along Townsend Street where much of the land use is commercial, business owners may prefer nighttime

construction since it would reduce disruption during normal business hours. The DPW waivers usually allow most construction processes to continue until 2 a.m., although construction processes that involve impacts are rarely allowed to extend beyond 10 p.m. This category would include equipment used in demolition such as jackhammers and hoe rams, and pile driving. It is not anticipated that the construction documents would have specific limits on nighttime construction. There may be times when nighttime construction is desirable (e.g., in commercial districts where nighttime construction would be less disruptive to businesses in the area) or necessary to avoid unacceptable traffic disruptions. Since the construction would be subject to the requirements of the San Francisco noise regulations, in these cases, the contractor would need to work with the DPW to come up with an acceptable approach balancing interruption of the business and residential community, traffic disruptions, and reducing the total duration of the construction.

**NoiC 2** – TJPA shall conduct noise monitoring. The purpose of monitoring is to ensure that contractors take all reasonable steps to minimize noise.

**NoiC 3** – TJPA shall conduct inspections and noise testing of equipment. This measure will ensure that all equipment on the site is in good condition and effectively muffled.

**NoiC 4** – TJPA shall implement an active community liaison program. This program would keep residents informed about construction plans so they can plan around periods of particularly high noise levels and would provide a conduit for residents to express any concerns or complaints about noise.

**NoiC 5** – TJPA shall minimize use of vehicle backup alarms. Because backup alarms are designed to get people's attention, the sound can be very noticeable even when their sound level does not exceed the ambient, and it is common for backup alarms at construction sites to be major sources of noise complaints. A common approach to minimizing the use of backup alarms is to design the construction site with a circular flow pattern that minimizes backing up of trucks and other heavy equipment. Another approach to reducing the intrusion of backup alarms is to require all equipment on the site to be equipped with ambient sensitive alarms. With this type of alarm, the alarm sound is automatically adjusted based on the ambient noise. In nighttime hours when ambient noise is low, the backup alarm is adjusted down.

**NoiC 6** – TJPA shall include noise control requirements in construction specifications. These should require the contractor to:

- Perform all construction in a manner to minimize noise. The contractor should be required to select construction processes and techniques that create the lowest noise levels. Examples are using predrilled piles instead of impact pile driving, mixing concrete offsite instead of onsite, and using hydraulic tools instead of pneumatic impact tools.
- Use equipment with effective mufflers. Diesel motors are often the major noise source on construction sites. Contractors should be required to employ equipment fitted with the most effective commercially available mufflers.

- Perform construction in a manner to maintain noise levels at noise sensitive land uses below specific limits.
- Perform noise monitoring to demonstrate compliance with the noise limits. Independent noise monitoring should be performed to check compliance in particularly sensitive areas.
- Minimize construction activities during evening, nighttime, weekend and holiday periods. Permits would be required before construction can be performed in noise sensitive areas during these periods.
- Select haul routes that minimize intrusion to residential areas. This is particularly important for the trench alternatives that will require hauling large quantities of excavation material to disposal sites.

Controlling noise in contractor work areas during nighttime hours is likely to require some mixture of the following approaches:

- Restrictions on noise producing activities during nighttime hours.
- Laying out the site to keep noise producing activities as far as possible from residences, to minimize the use of backup alarms, and to minimize truck activity and truck queuing near the residential areas.
- Use of procedures and equipment that produce lower noise levels than normal. For example, some manufacturers of construction equipment can supply special noise control kits with highly effective mufflers and other materials that substantially reduce noise emissions of equipment such as generators, tunnel ventilation equipment, and heavy diesel power equipment including mobile cranes and front-end loaders.
- Use of temporary barriers near noisy activities. By locating the barriers close enough to the noise source, it is possible to obtain substantial noise attenuation with barriers 10 to 12 feet high even though the residences are 30 to 40 feet higher than the construction site.
- Use of partial enclosures around noisy activities. It is sometimes necessary to construct shed-like structures or complete buildings to contain the noise from nighttime activities.

## 6. VIBRATION – OPERATIONS

See discussion of vibration impacts, Section 5.8.8 of the Final EIS/EIR. Mitigation measures include:

**VibO 1** – TJPA shall use high-resilience track fasteners or a resiliently supported tie system for the Caltrain Downtown Extension for areas projected to exceed vibration criteria, including the following locations: (1) Live/Work Condos, 388 Townsend Street (Hubbell and Seventh), (2) San Francisco Residences on Bryant (Harrison Parking Lot Site), (3) Clock Tower Building, and Second Street High Rise and (4) new Marriott Courtyard (Marine Firefighter's Union).[1]

[1] After mitigation, groundborne noise impact at 388 Townsend Street and vibration impact at the Clocktower Building would still exceed the FTA impact threshold by one decibel. This level of impact would not constitute a substantial adverse change requiring further mitigation, in terms of FTA guidance. The next level of vibration buffering that would be effective would be to install floating slab under the Caltrain alignment trackage for 600 to

## 7. VIBRATION – CONSTRUCTION

See discussion of construction vibration impacts, Section 5.21.10 of the Final EIS/EIR. Mitigation measures include:

**VibC 1** – TJPA shall limit or prohibit use of construction techniques that create high vibration levels. At a minimum, processes such as pile driving would be prohibited at distances less than 250 feet from residences.

**VibC 2** – TJPA shall restrict procedures that contractors can use in vibration sensitive areas. (It is often possible to employ alternative techniques that create lower vibration levels. For example, unrestricted pile driving is one activity that has considerable potential for causing annoying vibration. Using the cast-in-drilled-hole piling method instead will eliminate most potential for vibration impact from the piling.)

**VibC 3** – TJPA shall require vibration monitoring during vibration intensive activities.

**VibC 4** – TJPA shall restrict the hours of vibration intensive activities such as pile driving to weekdays during daytime hours.

**VibC 5** – TJPA shall investigate alternative construction methods and practices to reduce the impacts in coordination with the construction contractor if resident annoyance from vibration becomes a problem.

**VibC 6** – TJPA shall include specific limits, practices and monitoring and reporting procedures for the use of controlled detonation. Control and monitor use of controlled detonation to avoid damage to existing structures. Include specific limits, practices, and monitoring and reporting procedures within contract documents to ensure that such construction methods, if used, would not exceed safety criteria.

## 8. SOILS/GEOLOGY

See discussion of geologic impacts in Section 5.9 and construction impacts and approaches in Sections 5.20 and 5.21.17 of the Final EIS/EIR. Mitigation measures include:

**SG 1** – TJPA shall monitor adjacent buildings for movement and, if movement is detected, take immediate action to control the movement.

**SG 2** – TJPA shall apply geotechnical and structural engineering principles and conventional construction techniques similar to the design and construction of high-rise buildings and tunnels

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800 feet on either side of each building (at a construction cost of $1,000 per linear foot), which would add installed costs approaching one million dollars or even more per building. Such high costs would not be a prudent and reasonable expenditure to eliminate the last one decibel of impact at these two sites. Per FTA guidelines, "To be feasible, the measure, or combination of measures, must be capable of providing a significant reduction of the vibration levels, at least 5 dB, while being reasonable from the standpoint of the added cost."

throughout the downtown area. Apply design measures and utilize pile-supported foundations to mitigate potential settlement of the surface and underground stations.

**SG 3** – TJPA shall design and construct structural components of the Project to resist strong ground motions approximating the maximum anticipated earthquake (0.5g). The cut-and-cover portions will require pile supports to minimize non-seismic settlement in soft compressible sediments (Bay Mud). The underground Caltrain station at Fourth and Townsend will require pile-supported foundations due to the presence of underlying soft sediments.

**SG 4** – TJPA shall underpin existing building, where deemed necessary, to protect existing structures from potential damage that could result from excessive ground movements during construction. Design the tunneling and excavation procedures (and construction sequence), and design of the temporary support system with the objective of controlling ground deformations within small enough levels to avoid damage to adjacent structures. Where the risk of damage to adjacent structures is too great, special measures will be implemented such as: (1) underpinning, (2) ground improvement, and/or (3) strengthening of existing structures to mitigate the risks.

As part of the initial studies performed in 1996, preliminary plans were developed to protect/strengthen existing structures to mitigate the risk of adverse impacts of tunneling on existing structures. Underpinning, if it is deemed necessary, is one of the options for mitigating adverse effects of tunneling on the existing buildings. Underpinning involves modification of the foundations of the building so that the superstructure loads can be transferred beyond the zone of influence of tunneling. Underpinning may include internal strengthening of the superstructure, bracing, reinforcing the existing foundations, or replacing existing foundations with deep foundations embedded outside the tunnel zone of influence. Alternatives, in lieu of underpinning, involve strengthening the rock between the building and the crown of the tunnel. Grouting in combination with inclined pin piles can be used not only to strengthen the rock but make the rock mass over the tunnel act as a rigid beam, allowing construction of tunnels with no adverse effects on the buildings supported on shallow foundations over the tunnel.

Preliminary plans for underpinning have been developed that allow cost estimates to be made for underpinning. During the detailed design phase of the Project, underpinning plans will be developed specific to each of the buildings that may require it. It is not necessary at this stage of the Project to develop detailed underpinning plans.

These issues will be addressed on a case by case basis, along the alignment, during the detailed design phase of the Project. The methodology that is proposed for the Caltrain Downtown Extension, i.e., to design the support system to control ground deformations within tolerances and selectivity strengthen structures that may be too weak to resist even small deformations, was successfully used for the Muni Metro Turnback project, and are deemed to be effective for the Caltrain Downtown Extension Project as well.

**SG 5** – TJPA shall assure proper design and construction of pile-supported foundations for structures to control potential settlement of the surface. Stability of excavations and resultant impacts on adjacent structures can be controlled within tolerable limits by proper design and implementation of the excavation shoring systems.

## 9. UTILITIES

See discussion of utility impacts, Sections 5.12 and 5.21.12 of the Final EIS/EIR. Mitigation measures include:

**Util 1** – TJPA shall coordinate with utility providers during preliminary engineering, continuing through final design and construction. Utilities would be avoided, relocated, and/or supported as necessary during construction activities to prevent damage to utility systems and to minimize disruption and degradation of utility service to local customers.

## 10. CULTURAL AND HISTORIC RESOURCES

See discussion of cultural and historic resources impacts, Section 5.14 of the Final EIS/EIR. Mitigation measures include:

**CH 1** –Comply with the provision of the signed Memorandum of Agreement (MOA) between the Federal Transit Administration (FTA), the State Historic Preservation Officer (SHPO), and the TJPA[2].

**CH 2 – Professional Qualifications.** Assure all activities regarding history, historic preservation, historic architecture, architectural history, historic and prehistoric archaeology are carried out by or under the direct supervision of persons meeting, at a minimum, the Secretary of the Interior's professional qualifications standards (48 FR 44738-9) (PQS) in these disciplines. Nothing in this stipulation may be interpreted to preclude any signatory or any agent or contractor thereof from using the properly supervised services or persons who do not meet the PQS.

**Historic Preservation Standards.** Assure all activities regarding history, historic preservation, historic architecture, architectural history, historic and prehistoric archaeology are carried out to reasonably conform to the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716-44740) as well as to applicable standards and guidelines established by SHPO.

**Curation and Curation Standards.** Ensure that FTA and TJPA shall, to the extent permitted under sections 5097.98 and 5097.991.[sic] of the California Public Resources Code, materials and records resulting from any archaeological treatment or data recovery that may be carried out pursuant to this MOA, are curated in accordance with 36 CFR Part 79.

**CH 3** – Integrate into the design of the new terminal a dedicated space for a permanent interpretive exhibit. The interpretive exhibit will include at a minimum, but is not necessarily limited to: plaques or markers, a mural or other depiction of the historic Transbay Transit Terminal (TTT), ramps, or Key System, or other interpretive material.

**CH 4** – Consult with the State Department of Transportation (Department) regarding the availability of historical documentary materials for the creation of the permanent interpretive

[2] A copy of the Memorandum of Agreement is included as Appendix G of the Final EIS/EIR.

display of the history of the original TTT building and its association with the San Francisco-Oakland Bay Bridge. Department will assist TJPA in planning the scope and content of the proposed interpretive exhibit. Invite the Oakland Heritage Alliance, the San Francisco Architectural Heritage, the California State Railroad Museum, and the Western Railway Museum to participate in this consultation. While retaining responsibility for the development of the exhibit, TJPA will jointly consider the Department's and participating invitees' recommendations when finalizing the exhibit design. TJPA will produce, install, and maintain the exhibit.

**CH 5** – Consult with the City of Oakland about its possible interest in having a similar interpretive exhibit in the East Bay. If agreement is reached prior to completion of final design of the Transbay Terminal, TJPA will provide and deliver exhibit materials to a venue that is mutually satisfactory to TJPA and the City of Oakland.

**CH 6** – Identify, in consultation with Department, elements of the existing TTT that may be suitable for salvage and interpretive use by museums. Within two years following execution of this MOA by FTA and SHPO, TJPA will offer any elements identified as suitable for salvage and interpretive use to San Francisco Architectural Heritage, the California State Railroad Museum, Sacramento, the Western Railway Museum, the Oakland Museum, and any other interested parties. Remove any elements selected in a manner that minimizes damage and deliver with legal title to the recipient. Items not accepted by interested parties for salvage or interpretive use within the time frame specified herein will receive no further consideration.

**CH 7 – Oakland Museum of California Exhibit** – Consult with Department and the Oakland Museum about contributing to Department's exhibit and the production of an interpretive video at the Oakland Museum relating to the history and engineering of the major historic state bridges of the San Francisco Bay Area. TJPA will propose contributions to such an exhibit and video that would be related to the history of the TTT, bus ramp loop structures, and the Key System. Items contributed by TJPA to such an exhibit may include photographs, drawings, videotape, models, oral histories, and salvaged components from the TTT.

**CH 08** – Assist the Oakland Museum by contributing up to $50,000 toward the cost of preparing and presenting the exhibit and preparing an exhibit catalog or related museum publication in conjunction with the exhibit, in a manner and to the extent that is mutually satisfactory to TJPA, Department, and the Oakland Museum. A separate agreement will outline the negotiated financial contributions.

Work with the Oakland Museum and assist in the preparation of an exhibit and interpretive video if consultation results in agreement between TJPA and the Oakland Museum prior to demolition of the existing TTT.

**CH 9** – Request that SHPO, prior to the start of any work that would have an adverse effect on components of the Bay Bridge that are historic properties, determine whether these components, including the TTT and associated ramps, have been adequately recorded in existing documents. If SHPO determines that, collectively, such documents, which include the Department's past recordation of a series of remodeling and seismic retrofit project that have occurred since 1993, adequately document the TTT and ramps, then no further documentation will be necessary.

Seek, with the assistance of the Department, to obtain the original drawings of the TTT by architect T. Pflueger.

If SHPO determines that existing documentation is adequate, compile such documentation into a comprehensive record. Components to be included in the review of past documentation are:

- 425 Mission Transbay Transit Terminal (APN 3719-003, 3720-001, 3721-006);
- Upper Deck San Francisco Approaches or North Connector, Bridge #34-116F;
- Upper Deck San Francisco Approaches or Center Ramps, Bridge #34-118L;
- San Francisco Approaches or Lower Deck On-Ramp, Bridge #34-118R;
- Transbay Terminal Loop ramp, Bridge #34-119Y; and
- Harrison Street over-crossing Bridge #34-120Y.

Consult further with SHPO, if SHPO determines that existing documentation does not constitute adequate recordation of the Bay Bridge components addressed hereunder. SHPO will determine what level and type of additional documentation is necessary.

Provide xerographic copies of this documentation to the SHPO and the Department Headquarters Library, upon a written determination by SHPO that all documentation prescribed hereunder is satisfactory, to the History Center at the San Francisco Public Library, San Francisco Architectural Heritage, the Oakland History Room of the Oakland Public Library, the Oakland Museum of California, the Western Railway Museum, and Department District 4 Office. Thereafter, TJPA may proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder.

**CH 10** – Within 180 days after FTA determines that the Project has been completed, TJPA, in consultation with FTA and SHPO, will re-revaluate the Bay Bridge, a property listed on the NRHP, and determine whether the National Register nomination should be amended or whether the bridge no longer qualifies for listing and should be removed from the National Register. As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR Part 60 (60.14 and 60.15).

**CH 11** – Develop and implement measures, in consultation with the owners of historic properties immediately adjoining the construction sites, to protect the contributing elements of the Second and Howard Streets Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District from damage by any aspect of the Project. Such measures will include, but are not necessarily limited to those identified in the MOA.

The protective measures herein stipulated will be developed and implemented by TJPA prior to the commencement of any aspect of the Project that could have an adverse effect on historic properties immediately adjoining the construction sites herein identified. In addition, TJPA will monitor the effectiveness of the protective measures herein stipulated and will supplement or modify these measures as and where necessary in order to ensure that they are effective. The historic properties covered by the terms of this paragraph are shown in the following table.

| Affected Historic Properties During Construction | | | | |
|---|---|---|---|---|
| **Address/ Assessors Parcel Number** | **NRHP Status** | **Contributing Element of** | **Const. Date** | **Type of Impact** |
| 589-591 Howard Street / 3736-098 | 1D | Second & Howard District & New Montgomery / Second Street | 1906 | Cut-and-cover construction nearby |
| 163 Second Street / 3721-048 | 1D | | 1907 | |
| 166-78 Townsend Street / 3788-012 | 3D | Rincon Point/South Beach District & South End District | 1910 [1] 1988 [2] | Cut-and-cover construction nearby. Need construction easement |
| 640 Second Street / 3788-002 | 252 | Rincon Point/South Beach District & South End District | 1926 | Tunnel under or near property |
| 650 Second Street / 3788-049 through 3788-073 | 252 | | 1922 | |
| 670-680 Second Street / 3788-043, 3788-044 | 252 (670), 3D (680) | | 1913 | |
| 301-321 Brannan Street / 3788-037 | 3D | | 1909 | |
| 130 Townsend Street / 3788-008 | 3D | | 1910 [1] 1895-6 [2] | |
| 136 Townsend Street / 3788-009 | 3D | | 1902 [1] 1913 [2] | |
| 144-46 Townsend Street / 3788-009A | 3D | | 1922 | |
| 148-54 Townsend Street / 3788-010 | 3D | | 1922 | |
| 162-164 Townsend Street / 3788-081 | 3D | | 1919 | |

**Notes**: National Register Status Codes are as follows:

| | |
|---|---|
| 1 | Listed on the NRHP |
| 2S1 | Determined eligible for listing by the Keeper of the Register |
| 2S2 | Determined eligible for listing by the consensus of the SHPO and federal agency |
| 1D | Listed on the National Register as a contributor to a district or multi-resource property |
| 2D2 | Determined eligible as a contributor by consensus determination |
| 3D | Appears eligible as a contributor to a fully documented district |

[1] Caltrans, 1983, [2] Corbett and Bradley, 1996

Source: JRP Historical Consulting, Parsons Transportation Group, 2001

**CH 12** – TJPA will take the effect of the Project on the three historic properties listed below into account by recording these properties in accordance with the terms herein set forth. These buildings are:

- 191 2nd Street, (APN: 3721-022), and
- 580-586 Howard Street, (APN: 3721-092 through 3721-106), and
- 165-173 2nd Street, (APN: 3721-025).

Prior to taking any action that could adversely affect these properties, consult SHPO and SHPO will determine the type and level of recordation that is necessary for these properties. Upon a written determination by SHPO that all documentation prescribed hereunder is complete and satisfactory, submit a copy of this documentation to SHPO, with xerographic copies to the History Center at the San Francisco Public Library, San Francisco Architectural Heritage, and the Oakland History Room of the Oakland Public Library. Thereafter, proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder.

If SHPO does not respond within 45 days of receipt of each submittal of documentation prescribed herein, assume that SHPO has determined that said documentation is adequate and may proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder.

**CH 13** – Repair, in accordance with the Secretary of the Interior's Standards for Rehabilitation, any damage to contributing elements of the Second and Howard Streets Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District resulting from the Project.

Photograph the condition of the contributing elements prior to the start of the Project to establish the baseline condition for assessing damage. Consult with property owner(s) about the appropriate level of photographic documentation of building interiors and exteriors. Provide a copy of this photographic documentation to the property owner(s), and retain on file.

Submit repair plans and specifications to SHPO for review and comment, if repair of inadvertent damage resulting from the Project is necessary, to ensure that the work conforms to the Secretary of the Interior's Standards for Rehabilitation. Consult with SHPO to establish a mutually satisfactory time frame for the SHPO's review. TJPA will carry out any repairs required hereunder in accordance with the comments of SHPO.

**CH 14** – Within 180 days after FTA determines that the Project has been completed, TJPA, in consultation with FTA and SHPO, will re-revaluate the Second and Howard Streets Historic District and determine whether the National Register nomination should be amended or whether the district no longer qualifies for listing and should be removed from the National Register. As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR Part 60 (60.14 and 60.15).

**CH 15** – Within 45 days following execution of MOA, consult with FTA, SHPO, JPB and CCSF to initiate the process of determining how archaeological properties that may be affected by the Project will be identified, whether and how the NRHP eligibility of such properties may be addressed, and whether and how the Project's effects, if any, on those archaeological properties

that may be considered historic properties for purposes of this MOA, may be taken into account. FTA and TJPA to invite Caltrans to participate in this consultation. Determine the time frame for this consultation with the consulting parties through consensus.

Consultation will at minimum be informed by, and take into account, the following documents: Attachment 6, "Standard Treatment of Archaeological Sites: Data Recovery Plan," of the "Programmatic Agreement among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Office, and the California Department of Transportation regarding compliance with Section 106 of the National Historic Preservation Act, as it pertains to the Administration of the Federal Aid Highway Program in California;" "Archaeological Research Design and Treatment Plan for SF-480 Terminal Separation Rebuild (Praetzellis and Praetzellis, 1993)" and " The San Francisco-Oakland Bay Bridge, West Approach Replacement: Archaeological Research Design and Treatment Plan (Ziesing, 2000); "Revised Historical Archaeology Research Design for the Central Freeway Replacement Project (Thad M. Van Bueren, Mary Praetzellis, Adrian Praetzellis, Frank Lortie, Brian Ramos, Meg Scantlebury and Judy D. Tordoff)."

**CH 16** – If the consulting parties agree that a treatment plan for archaeological properties should be prepared, prepare a Treatment Plan for archeological resources that provides for the identification, evaluation, and treatment of archaeological properties that may be affected by the Project and that conform to the requirements above of item CH13 1) and take into account the information contained in items CH13 2) and CH13 3) and conform to any other standards, documentation, or guidance that the consulting parties may specify

If the consulting parties agree that the Treatment Plan will address historic archaeological properties as well as prehistoric archaeological properties, ensure that appropriately qualified historians prepare a historic context(s) that will be used by an interdisciplinary team consisting at a minimum of historians and historic archaeologist.

The historic context will, at a minimum:

1) identify significant research themes and topics that relate to the historic period(s) addressed by the historic context(s)

2) determine what types of historic archaeological properties, if any, that may usefully and significantly contribute to research themes and topics deemed by the historic context(s) study to be important

3) identify the specific components and constituents (features, artifacts, etc., if any, of historic archaeological property types that can factually and directly, contribute data important to our understanding of significant historic research themes and topics

4) determine the amount (sample size, etc.) of archaeological excavation and related activity that is needed to provide the range and type of factual data that will contribute to our understanding of significant historic research themes and topics

Submit the draft Treatment Plan to the other consulting parties for review and comment. The consulting parties have 45 days from receipt of the draft Treatment Plan to comment in writing to FTA and TJPA. Failure of the consulting parties to respond within this time frame shall not preclude FTA and TJPA from finalizing the draft Treatment Plan to their satisfaction.
Before finalizing the draft Treatment Plan, FTA and TJPA to provide the consulting parties with written documentation indicating whether and how the draft Treatment Plan will be modified. Unless any consulting party objects to this documentation in writing to FTA and TJPA within 15 days following receipt, finalize the draft Treatment Plan as deemed appropriate by FTA and TJPA, and proceed to implement the final Treatment Plan.

If FTA and TJPA propose to modify the final Treatment Plan, they will notify the consulting parties concurrently in writing about the proposed modifications. The consulting parties will have 15 days from receipt of notification to comment in writing to FTA and TJPA. Failure of the consulting parties to respond within this time frame shall not preclude FTA and TJPA from modifying the final Treatment Plan to their satisfaction.

Before modifying the final Treatment Plan, FTA and TJPA will provide the consulting parties with written documentation indicating whether and how the final Treatment Plan will be modified. Unless any consulting party objects to this documentation in writing to FTA and TJPA within 15 days following receipt, modify the final Treatment Plan as appropriate, and proceed to implement the modified final Treatment Plan.

**CH 17** - 1) Within two years after FTA, in consultation with TJPA, has determined that all fieldwork required by the Treatment Plan has been completed, prepare a draft technical report that documents the results of implementing the Treatment Plan and distributes this draft technical report to the other MOA signatories for review. The reviewing parties will be afforded 60 days following receipt of the draft technical report to submit any written comments to FTA and TJPA. Failure of the reviewing parties to respond within this time frame shall not preclude FTA from authorizing TJPA to revise the draft technical report as FTA and TJPA deem appropriate.
FTA will provide the reviewing parties with a written documentation indicating modifications in accordance with any reviewing party comments. Unless the reviewing parties object to this documentation in writing to FTA and TJPA within 30 days following receipt, modify the draft technical report as FTA and TJPA deem appropriate. Thereafter, issue the technical report in final form and distribute this document in accordance with paragraph CH15 2).

2) Distribute copies of the final technical report documenting the results of the Treatment Plan implementation to the other signatory parties, to any consulting Native American Tribe if prehistoric, protohistoric or ethnographic period archaeological properties were located and addressed under the Treatment Plan, and to the appropriate California Historical Resources Information Survey (CHRIS) Regional Information Center, subject to the terms of Stipulation IV. E (CH19).

3) Prepare a written draft document that communicates in lay terms the results of Treatment Plan implementation to members of the interested public. Distribute this written draft document for review and comment concurrently with and in the same manner as that prescribed for the draft written technical report prescribed by paragraph C.1. of this stipulation. If the draft document

prescribed hereunder is a publication such as a report or brochure, then distribute such publication to the other signatory parties, to any consulting Native American Tribe as applicable, and to any other entity that the signatory parties and, as applicable, any consulting Native American Tribe, through consultation as appropriate, subject to the terms of Stipulation IV.E (CH 19).

4) Prepare a written annual report describing the status of its efforts to comply with the terms of Stipulations II – IV, inclusive, of this MOA. Prepare the annual report following the end of each fiscal year (July 1 to June 30) that this MOA is in effect and distributed it to all MOA signatories by July 30 of each year until FTA and the SHPO through consultation determine that the requirements of stipulations II – IV, inclusive of this MOA have been satisfactorily completed.

**CH 18 -** If the consulting parties agree that a plan for treatment of archaeological properties will not be prepared, then address any archaeological properties discovered during implementation of any aspect of the Project pursuant to 36 CFR 800.13(b)(3).
If the consulting parties agree that a plan for treatment of archaeological properties will not be prepared, then any archaeological properties discovered during implementation of any aspect of the Project will be addressed by TJPA pursuant to 36 CFR 800.13(b)(3).

**CH 19 -** The signatories to the MOA acknowledge that historic properties covered by this MOA are subject to the provisions of Section 304 of the National Historic Preservation Act of 1966, as amended, and Section 6254.10 of the California Government Code (Public Records Act), relating to the disclosure of archaeological site information and, having so acknowledged, will ensure that all actions and documentation prescribed by this Agreement are consistent with Section 304 of the National Historic Preservation Act of 1966, as amended, and Section 6254.10 of the California Government Code.

**CH 20 -** The parties to the MOA agree that Native American burials and related items discovered during implementation of the terms of the MOA and of the Project will be treated in accordance with the requirements of Section 7050.5(b) of the California Health and Safety Code. If, pursuant to Section 7050.5(c) of the California Health and Safety Code, the county coroner/medical examiner determines that the human remains are, or may be of Native American origin, then the discovery shall be treated in accordance with the provisions of Section 5097.98(a)-(d) of the California Public Resources Code. TJPA will ensure that to the extent permitted by applicable law and regulation, the views of any consulting Native American Tribe and the Most Likely Descendant(s) are taken into consideration when decisions are made about the disposition of other Native American archaeological materials and records.

## 11. HAZARDOUS MATERIALS/WASTE - OPERATIONS

See discussion of hazardous material and waste impacts, Section 5.15 of the Final EIS/EIR. Mitigation measures include:

**HWO 1** – The Peninsula Corridor Joint Powers Board (JPB) – the agency responsible for operating Caltrain – shall construct and operate any fueling facility in compliance with local, state and Federal regulations regarding handling and storage of hazardous materials.

**HWO 2** – JPB shall equip diesel fuel pumps with emergency shut-off valves and, in compliance with U.S. EPA requirements, fuel Underground Storage Tanks (USTs) would be equipped with leak detection and monitoring systems.

**HWO 3** – JPB shall employ the use of secondary containment systems for any aboveground storage tanks.

**HWO 4** – JPB shall store cleaning solvents in 55-gallon drums, or other appropriate containers, within a bermed area to provide secondary containment.

**HWO 5** – JPB shall slope paved surfaces within the fueling facility and the solvent storage area to a sump where any spilled liquids could be recovered for proper disposal.

**HWO 6** – JPB shall follow California OSHA and local standards for fire protection and prevention for the handling and storage of fuels and solvents.

**HWO 7** – JPB shall prepare a Hazardous Materials Management/ Business Plan and file with the San Francisco Department of Public Health.

**12. HAZARDOUS MATERIALS/WASTE – CONSTRUCTION**

See discussion of hazardous material and waste impacts during construction, Section 5.21.15 of the Final EIS/EIR. Mitigation measures include:

**HMC 1** – TJPA shall follow California OSHA and local standards for fire protection and prevention. Handling and storage of fuels and other flammable materials during construction

will conform to these requirements, which include appropriate storage of flammable liquids and prohibition of open flames within 50 feet of flammable storage areas.

**HMC 2** – TJPA shall perform detailed investigations of the potential presence of contaminants in soil and groundwater prior to construction, using conventional drilling, sampling, and chemical testing methods. Based on the chemical test results, a mitigation plan will be developed to establish guidelines for the disposal of contaminated soil and discharge of contaminated dewatering effluent, and to generate data to address potential human health and safety issues that may arise as a result of contact with contaminated soil or groundwater during construction. The investigation and mitigation plan will follow the requirements of the City and County of San Francisco's Article 22A in the appropriate areas along the alignment.

With construction projects of this nature and magnitude, there are typically two different management strategies that can be employed to address contaminated soil handling and disposal issues. Contaminated soil can be excavated and stockpiled at a centralized location and subsequently sampled and analyzed for disposal profiling purposes in accordance with the requirements of the candidate disposal landfill. Alternatively, soil profiling for disposal purposes can be done in-situ so when soil is excavated it is loaded directly on to trucks and hauled to the appropriate landfill facility for disposal based on the in-situ profiling results. A project of this nature could also combine both strategies.

**HMC 3** – TJPA shall cover with plastic sheeting soils removed during excavation and grading activities that remain at a centralized location for an extended period of time to prevent the generation of fugitive dust emissions that migrate offsite.

**HMC 4** – TJPA shall use a licensed waste hauler, applying appropriate manifests or bill of lading procedures, as required to haul soil for disposal at a landfill or recycling facility.

**HMC 5** – TJPA shall use chemical test results for groundwater samples along the alignment to obtain a Batch Discharge Permit under Article 4.1 of the San Francisco Department of Public Works as well as to evaluate requirements for pretreatment prior to discharge to the sanitary sewer. Effluent produced during the dewatering of excavations will be collected in onsite storage tanks and periodically tested, as required under discharge permit requirements, for potential contamination to confirm the need for any treatment prior to discharge. If required, treatment may include:

- Settling to allow particulate matter (total suspended solids) to settle out of the effluent in order to reduce the sediment load as well as reduce elevated metal and other contaminant concentrations that may be associated with suspended sediments; and/or
- Construction of a small-scale batch waste water treatment system to remove dissolved contaminants (mainly organic constituents such as petroleum hydrocarbons (gas, diesel, and oils), BTEX, and VOCs) from the dewatering effluent prior to discharge to the sanitary sewer. A treatment system would also likely employ the use of filtration to remove suspended solids.

**HMC 6** – TJPA shall develop a detailed mitigation plan for the handling of potentially contaminated soil and groundwater prior to starting Project construction.

**HMC 7** – TJPA shall design dewatering systems to minimize downward migration of contaminants that can result from lowering the water table if necessary based on environmental conditions. As necessary, shallow soils with detected contamination would be dewatered first using wells screened only in those soils. Dewatering of deeper soils would then be performed using wells screened only in the zone to be dewatered. Dewatering wells would be installed using drilling methods that prohibit shallow contaminated soils from being carried deeper into the boreholes.

**HMC 8** – TJPA shall require that workers performing activities on site that may involve contact with contaminated soil or groundwater have appropriate health and safety training in accordance with 29 CFR 1910.120.

A Worker Health and Safety Plan (HSP) will be developed for the Project and monitored for the implementation of the plan on a day-to-day basis by a Certified Industrial Hygienist (CIH). The HSP will include provisions for:

- Conducting preliminary site investigations and analysis of potential job hazards;
- Personnel protective equipment;
- Safe work practices;
- Site control;
- Exposure monitoring;
- Decontamination procedures; and
- Emergency response actions.

The HSP will specify mitigation of potential worker and public exposure to airborne contaminant migration by incorporating dust suppression techniques in construction procedures. The plan will also specify mitigation of worker and environmental exposure to contaminant migration via surface water runoff pathways by implementation of comprehensive measures to control drainage from excavations and saturated materials excavated during construction.

**HMC 9** – TJPA shall review existing asbestos surveys, abatement reports, and supplemental asbestos surveys, as warranted. Perform an asbestos survey for buildings to be demolished, as required. Asbestos-containing building materials (ACM) will require abatement prior to building demolition. Removal and disposal of ACM will be performed in accordance with applicable local, state, and federal regulations.

**HMC 10** – TJPA shall perform a lead-based paint survey for buildings to be demolished to determine areas where lead-based paint is present and the possible need for abatement prior to demolition.

## 13. PEDESTRIANS

See discussion of pedestrian impacts, Section 5.19.6.1 of the Final EIS/EIR. Mitigation measures include:

**Ped 1** – Agency and City shall use future construction or redevelopment as opportunities to increase building set-backs thereby increasing sidewalk widths. Particular areas where such widening is most needed include:

- Southeast corner Fremont/Mission Street;
- Northeast corner First/Mission Street;
- North side of Mission Street between First and Fremont; and
- Sidewalks south of Howard Street along Folsom, First, Fremont, and Beale that are less than 10 feet wide.

**Ped 2** – Agency and City shall eliminate or reduce sidewalk street furniture such as newspaper boxes and magazine racks in the immediate Transbay Terminal area on corners.

**Ped 3** – City shall retime traffic light signalization. This could improve pedestrian levels of service at each of the intersections studies that fall into LOS F.

**Ped 4** – City shall provide crosswalk signalization at intersections where they do not exist already, such as Folsom and Beale streets.

**Ped 5** – City shall provide cross-walk count-down signals at intersections and cross-walks immediately surrounding the new Transbay Terminal.

**Ped 6** –TJPA shall ensure that Transbay Terminal design increases corner and sidewalk widths at the four intersections immediately surrounding the Transbay Terminal.

**Ped 7** – TJPA shall provide lights within crosswalks to warn when pedestrians are present in the crosswalk, such as at the cross-walk associated with the mid-block bus loading area.

## 14. PRE-CONSTRUCTION ACTIVITIES

See discussion of construction impacts, Section 5.20.1 of the Final EIS/EIR. Mitigation measures include:

**PC 1** – TJPA shall complete a pre-construction building structural survey to determine the integrity of existing buildings adjacent to and over the proposed Caltrain Downtown Extension. Use this survey to finalize detailed construction techniques along the alignment and as the baseline for monitoring construction impacts during and following construction.

**PC 2** – TJPA shall contact and interview individual businesses along the Caltrain Extension alignment to gather information and develop an understanding of how these businesses carry out

their work. This survey will identify business usage, delivery/shipping patterns, and critical times of the day or year for business activities. Use this information to assist in: (a) the identification of possible techniques during construction to maintain critical business activities, (b) analyze alternative access routes for customers and deliveries to businesses, (c) develop traffic control and detour plans, and (d) finalize construction practices.

**PC 3** – TJPA shall complete detailed geotechnical investigation, including additional sampling (drilling and core samples) and analyses of subsurface soil/rock conditions. Use this information to design the excavation and its support system to be used in the retained cut, cut-and-cover, and tunnel portions of the Caltrain Downtown Extension.

**PC 4** – TJPA shall establish community construction information/outreach program to provide on-going dialogue among the TJPA and the affected community regarding construction impacts and possible mitigation/solutions. Include dedicated personnel for an outreach office in the construction area to deal with construction coordination.

**PC 5** – TJPA shall establish site and field offices located along the Caltrain Downtown Extension alignment. Field office staff, in conjunction with other staff, will:

- Provide the community and businesses with a physical location where information pertaining to construction can be exchanged,
- Enable TJPA and JPB to better understand community/business needs during the construction period,
- Allow TJPA and JPB to participate in local events in an effort to promote public awareness of the Project,
- Manage construction-related matters pertaining to the public,
- Notify property owners, residences, and businesses of major construction activities (e.g., utility relocation/disruption and milestones, re-routing of delivery trucks),
- Provide literature to the public and press,
- Promote and provide presentations on the Project via a Speakers Bureau,
- Respond to phone inquires,
- Coordinate business outreach programs,
- Schedule promotional displays, and
- Participate in community committees.

**PC 6** – TJPA shall implement an information phone line to provide community members and businesses the opportunity to express their views regarding construction. Review calls received and, as appropriate, forward the message to the necessary party for action (e.g., utility company, fire department, the Resident Engineer in charge of construction operations). Information available from the telephone line will include current Project schedule, dates for upcoming community meetings, notice of construction impacts, individual problem solving, construction

complaints and general information. Phone service would be provided in English, Cantonese, and Spanish and would be operated on a 24-hour basis.

**PC 7** – TJPA shall develop traffic management plans. Traffic management plans to maintain access to all businesses will be prepared for areas affected by surface or cut-and-cover construction. In addition, daily cleaning of work areas would be performed by contractors for the duration of the construction period. Provisions would be contained in construction contracts to require the maintenance of driveway access to businesses to the extent feasible.

## 15. GENERAL CONSTRUCTION MEASURES

See discussion of construction staging and methods and construction impacts, Sections 5.20 and 5.21 of the Final EIS/EIR. Mitigation measures include:

**GC 1** – TJPA shall disseminate information to community in a timely manner regarding anticipated construction activities.

**GC 2** – TJPA shall provide signage. Work with establishments affected by construction activities to develop appropriate signage for display that directs both pedestrian and vehicular traffic to businesses via alternate routes.

**GC 3** – TJPA shall install level deck. Install decking at the cut-and-cover sections to be flush with the existing street or sidewalk levels.

**GC 4** – TJPA shall provide for efficient sidewalk design and maintenance. Wherever feasible, maintain sidewalks at the existing width during construction. Where a sidewalk must be temporarily narrowed during construction (e.g., deck installation), restore it to its original width during the majority of construction period. (In some places this may require placing the temporary sidewalk on the deck.) Each sidewalk design should be of good quality and approved by the Resident Engineer prior to construction. Handicapped access will be maintained during construction where feasible.

**GC 5** – TJPA shall provide construction site fencing of good quality, capable of supporting the accidental application of the weight of an adult without collapse or major deformation. Where covered walkways or other solid surface fencing is installed, establish a program to allow for art work (e.g., by local students) on the surface(s).

## 16. AIR EMISSIONS – CONSTRUCTION

See discussion of air emission impacts from construction, Section 5.21.9 of the Final EIS/EIR. The following mitigation measures are derived from the "basic control measures" and the "enhanced control measures" recommended by the Bay Area Air Quality Management District (BAAQMD). Mitigation measures include:

**AC 1** – TJPA shall assure that, as part of the contract provisions, the Project contractor is required to implement the measures below at all Project construction sites.

**AC 2** – TJPA shall water all active construction areas at least twice daily. Ordinance 175-91, passed by the San Francisco Board of Supervisors on May 6, 1991, requires that non-potable water be used for dust control activities; therefore, the Project contractor would be required to obtain reclaimed water from the City's Clean Water Program or other appropriate sources.

**AC 3** – TJPA shall cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard.

**AC 4** – TJPA shall pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.

**AC 5** – TJPA shall sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites.

**AC 6** – TJPA shall sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets.

**AC 7** – TJPA shall install sandbags or other erosion control measures to prevent silt runoff to public roadways.

**AC 8** – TJPA shall replant vegetation in disturbed areas as quickly as possible.

**AC 9** – TJPA shall minimize use of on-site diesel construction equipment, particularly unnecessary idling.

**AC 10** – TJPA shall shut off construction equipment to reduce idling when not in direct use.

**AC 11** – TJPA shall, where feasible, replace diesel equipment with electrically powered machinery.

**AC 12** – TJPA shall locate diesel engines, motors, or equipment as far away as possible from existing residential areas.

**AC 13** – TJPA shall properly tune and maintain all diesel power equipment.

**AC 14** – TJPA shall suspend grading operations during first and second stage smog alerts, and during high winds, i.e., greater than 25 miles per hour.

**AC 15** – TJPA, shall, upon completion of the construction phase, buildings with visible signs of dirt and debris from the construction site shall be power washed and/or painted (given that permission is obtained from the property owner to gain access to and wash the property with no fee charged by the owner).

## 17. VISUAL/AESTHETICS – CONSTRUCTION

See discussion of visual/aesthetic impacts from construction, Section 5.21.16 of the Final EIS/EIR. Short-term visual changes as a result of construction activities are a common and accepted feature of the urban environment, and generally, mitigation is not required. Nonetheless, mitigation measures include:

**VA 1** – TJPA shall assure that construction crews working at night direct any artificial lighting onto the work site in order to minimize "spill over" light or glare effects on adjacent areas.

**VA 2** – TJPA shall assure that contractors make all efforts possible to minimize specific aesthetic and visual effects of construction identified by neighborhood businesses and residents.

# TRANSBAY TERMINAL/CALTRAIN DOWNTOWN EXTENSION/ REDEVELOPMENT PROJECT MITIGATION MONITORING AND REPORTING PROGRAM

## INTRODUCTION

Assembly Bill (AB) 3180 was enacted by the State Legislature to provide a mechanism to ensure that mitigation measures adopted through the California Environmental Quality Act ("CEQA") process are implemented in a timely manner and in accordance with the terms of project approval. Under AB 3180, local agencies are required to adopt a monitoring or reporting program designed to ensure compliance during project implementation.

The Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project Mitigation Monitoring and Reporting Program ("Mitigation Monitoring Program"), pursuant to AB 3180, CEQA Section 21081.6 and CEQA Guidelines Section 15091, provides the basic framework through which adopted mitigation measures will be monitored to ensure implementation.

## ORGANIZATION

The Mitigation Monitoring Program is organized in a table format, keyed to each adopted Final EIS/EIR mitigation measure. For each measure, the table: (1) lists the mitigation measure; (2) specifies the party responsible for implementing the measure; (3) establishes a schedule for mitigation implementation; (4) assigns mitigation monitoring responsibility; and (5) establishes monitoring actions and a schedule for mitigation monitoring.

## IMPLEMENTATION

While the Mitigation Monitoring Program generally outlines the actions, responsibilities and schedule for mitigation monitoring, it does not attempt to specify the detailed procedures to be used to verify implementation (e.g., interactions between the Project Sponsor – the Transbay Joint Powers Authority, the San Francisco Redevelopment Agency and City departments, use of private consultants, signed-off on plans, site inspections, etc.). Specific monitoring procedures are either contained in approval documents or will be developed at a later date, closer to the time the mitigation measures will actually be implemented.

The majority of the measures will be monitored primarily by the Transbay Joint Powers Authority (TJPA), in consultation with other City and non-City agencies, as part of the site permit, building permit processes or other report.

# TRANSBAY TERMINAL/CALTRAIN DOWNTOWN EXTENSION/REDEVELOPMENT PROJECT
# FEIS/FEIR MITIGATION MONITORING AND REPORTING PROGRAM

| MITIGATION MEASURE | Responsibility for Implementation | MITIGATION SCHEDULE | Monitoring Responsibility | Monitoring Actions/Schedule |
|---|---|---|---|---|
| **Wind** | | | | |
| **W 1** – Consider potential wind effects of an individual project for the Redevelopment area. If necessary, perform wind tunnel testing in accordance with City Planning Code Section 148. If exceedences of the wind hazard criterion should occur for any individual project, require design modifications or other mitigation measures to mitigate or eliminate these exceedences. Tailor mitigation measures to the individual needs of each project. Examples of mitigation measures include articulation of building sides and softening of sharp building edges. | San Francisco Redevelopment Agency (Agency) | During environmental review process preceding approval of each individual project in Transbay Redevelopment Area | Agency | Apply project review procedures for wind when projects are developed by or proposed to Agency. |
| **Property Acquisition/Relocation** | | | | |
| **Prop 1** – Apply federal Uniform Relocation Act (Public Law 91 646) and California Relocation Act (Chapter 16, Section 7260 et seq., of the Government Code) and related laws and regulations governing both land acquisition and relocation. All real property to be acquired will be appraised to determine its fair market value before an offer is made to each property owner. (Minimum relocation payments are detailed in the laws, and include moving and search payments for businesses.) Provide information, assistance, and payments to all displaced businesses in accordance with these laws and regulations. | City and County of San Francisco (CCSF), Agency, and TJPA | Prior to and during property acquisition and relocation activities | TJPA | TJPA to report to Board on compliance during acquisition and relocation activities. |
| **Safety and Emergency Services** | | | | |
| **Saf 1** – Provide project plans to the San Francisco Fire Department for its review to ensure that adequate life safety measures and emergency access are incorporated into the design and construction of Project facilities | Transbay Joint Powers Authority (TJPA) | Prior to project facility permitting and during construction | TJPA | Project facility plans to be forwarded to CCSF Fire Department prior to permit issuance.<br>Inspect installation during construction. |

| MITIGATION MEASURE | Responsibility for Implementation | MITIGATION SCHEDULE | Monitoring Responsibility | Monitoring Actions/Schedule |
|---|---|---|---|---|
| **Saf 2** – Prepare a life safety plan including the provision of on-site measures such as a fire command post at the Terminal, the Fire Department's 800-megahertz radio system and all necessary fire suppression equipment | TJPA | Prior to project facility permitting | TJPA | TJPA to develop life safety plan during facility design phases and implement during testing and startup up phase. |
| **Saf 3** – Prepare a risk analysis to accurately determine the number of personnel necessary to maintain an acceptable level of service at Project facilities. | TJPA | Prior to project facility permitting | TJPA | TJPA to develop risk analysis during facility design phase. |
| **Noise – Operations** | | | | |
| **NoiO 1** – Apply noise mitigation at the following locations adjacent to the bus storage facility:<br>• Provide sound insulation to mitigate noise impacts at the residences north of the AC Transit Facility at the corner of Perry and Third Street. At a minimum, apply sound insulation to the façade facing the bus storage facility (the south façade).<br>• Construct two noise barriers to mitigate noise impacts to residences south of the AC Transit Facility along Stillman Street. The first noise barrier would be approximately 10 to 12 feet high and run along the southern edge of the AC Transit storage facility. The second noise barrier would be approximately 5 to 6 feet high and would be located on the portion of the ramp at the southwestern corner of the AC Transit facility. Treat the noise barriers with an absorptive material on the side facing the facility to minimize the potential for reflections off the underside of the freeway.<br>• Construct a noise barrier to mitigate noise impacts to residences south of the Golden Gate Transit Facility along | TJPA | During construction | TJPA | TJPA to design detailed noise mitigation during preliminary and final design phases. TJPA engineering staff to inspect installation and/or construction of mitigation measures. |

| MITIGATION MEASURE | Responsibility for Implementation | Mitigation Schedule | Monitoring Responsibility | Monitoring Actions/Schedule |
|---|---|---|---|---|
| Stillman Street. The barrier would be approximately 10 to 12 feet high and run along the southern and a portion of the eastern edge of the Golden Gate Transit storage facility. Treat the noise barriers with an absorptive material on the side facing the facility to minimize the potential for reflections off the underside of the freeway. | | | | |
| **NoiO 2** – Landscape the noise walls. Develop the actual design of the walls in cooperation with area residents. | TJPA | During preliminary and final design | TJPA | TJPA to work with area residents during design of noise walls. |
| **NoiO 3** – Construct noise walls prior to the development of the permanent bus facilities. | TJPA | During schedule development, construction document preparation and construction | TJPA | TJPA to develop program schedule and contract documents to implement this construction sequencing requirement. |
| **Noise – Construction** | | | | |
| **NoiC 1** – Comply with San Francisco noise ordinance. The noise ordinance includes specific limits on noise from construction. The basic requirements are:<br>• Maximum noise level from any piece of powered construction equipment is limited to 80 dBA at 100 feet. This translates to 86 dBA at 50 feet.<br>• Impact tools are exempted, although such equipment must be equipped with effective mufflers and shields. The noise control equipment on impact tools must be as recommended by the manufacturer and approved by the Director of Public Works. | TJPA | During preparation of construction contract documents and construction | TJPA | TJPA to work with CCSF Department of Public Works (DPW) regarding construction noise mitigation program. |

| MITIGATION MEASURE | Responsibility for Implementation | Mitigation Schedule | Monitoring Responsibility | Monitoring Actions/Schedule |
|---|---|---|---|---|
| • Construction activity is prohibited between 8 p.m. and 7 a.m. if it causes noise that exceeds the ambient noise plus 5 dBA<br>The noise ordinance is enforced by the San Francisco DPW, which may waive some of the noise requirements to expedite the project or minimize traffic impacts. For example, along Townsend Street where much of the land use is commercial, business owners may prefer nighttime construction since it would reduce disruption during normal business hours. The DPW waivers usually allow most construction processes to continue until 2 a.m., although construction processes that involve impacts are rarely allowed to extend beyond 10 p.m. This category would include equipment used in demolition such as jackhammers and hoe rams, and pile driving. It is not anticipated that the construction documents would have specific limits on nighttime construction. There may be times when nighttime construction is desirable (e.g., in commercial districts where nighttime construction would be less disruptive to businesses in the area) or necessary to avoid unacceptable traffic disruptions. Since the construction would be subject to the requirements of the San Francisco noise regulations, in these cases, the contractor would need to work with the DPW to come up with an acceptable approach balancing interruption of the business and residential community, traffic disruptions, and reducing the total duration of the construction. | | | | |
| **NoiC 2** – Conduct noise monitoring. The purpose of monitoring is to ensure that contractors take all reasonable steps to minimize noise. | TJPA | During construction | TJPA | Monitoring data to be provided to CCSF DPW. |
| **NoiC 3** – Conduct inspections and noise testing of equipment. This measure will ensure that all equipment on the site is in good condition and effectively muffled | TJPA | During construction | TJPA | Perform monitoring during construction. |

| MITIGATION MEASURE | Responsibility for Implementation | Mitigation Schedule | Monitoring Responsibility | Monitoring Actions/Schedule |
|---|---|---|---|---|
| **NoiC 4** – Implement an active community liaison program. This program would keep residents informed about construction plans so they can plan around periods of particularly high noise levels and would provide a conduit for residents to express any concerns or complaints about noise. | TJPA | During construction | TJPA | TJPA to develop and initiate community liaison program during final design prior to construction. Program will continue during construction. |
| **NoiC5** – Minimize use of vehicle backup alarms. Because backup alarms are designed to get people's attention, the sound can be very noticeable even when their sound level does not exceed the ambient, and it is common for backup alarms at construction sites to be major sources of noise complaints. A common approach to minimizing the use of backup alarms is to design the construction site with a circular flow pattern that minimizes backing up of trucks and other heavy equipment. Another approach to reducing the intrusion of backup alarms is to require all equipment on the site to be equipped with ambient sensitive alarms. With this type of alarm, the alarm sound is automatically adjusted based on the ambient noise. In nighttime hours when ambient noise is low, the backup alarm is adjusted down. | TJPA | During construction document preparation and construction | TJPA | Review contract specifications during final design and inspect construction. |
| **NoiC 6** – Include noise control requirements in construction specifications. These should require the contractor to<br>• Perform all construction in a manner to minimize noise. The contractor should be required to select construction processes and techniques that create the lowest noise levels. Examples are using predrilled piles instead of impact pile driving, mixing concrete offsite instead of onsite, and using hydraulic tools instead of pneumatic impact tools. | TJPA | Final design and construction | TJPA | TJPA to develop detailed noise control requirements during preliminary engineering and final design. Ensure contractor obtains permits if necessary. Inspect construction activities for compliance and monitor noise levels. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such |

| MITIGATION MEASURE | Responsibility for Implementation | Mitigation Schedule | Monitoring Responsibility | Monitoring Actions/Schedule |
|---|---|---|---|---|
| • Use equipment with effective mufflers. Diesel motors are often the major noise source on construction sites. Contractors should be required to employ equipment fitted with the most effective commercially available mufflers.<br>• Perform construction in a manner to maintain noise levels at noise sensitive land uses below specific limits.<br>• Perform noise monitoring to demonstrate compliance with the noise limits. Independent noise monitoring should be performed to check compliance in particularly sensitive areas.<br>• Minimize construction activities during evening, nighttime, weekend and holiday periods. Permits would be required before construction can be performed in noise sensitive areas during these periods.<br>• Select haul routes that minimize intrusion to residential areas. This is particularly important for the trench alternatives that will require hauling large quantities of excavation material to disposal sites.<br>Controlling noise in contractor work areas during nighttime hours is likely to require some mixture of the following approaches:<br>• Restrictions on noise producing activities during nighttime hours.<br>• Laying out the site to keep noise producing activities as far as possible from residences, to minimize the use of backup alarms, and to minimize truck activity and truck queuing near the residential areas.<br>• Use of procedures and equipment that produce lower noise | | | | CCSF Department of Parking and Traffic (DPT) and DPW. |

| MITIGATION MEASURE | Responsibility for Implementation | Mitigation Schedule | Monitoring Responsibility | Monitoring Actions/Schedule |
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| levels than normal. For example, some manufacturers of construction equipment can supply special noise control kits with highly effective mufflers and other materials that substantially reduce noise emissions of equipment such as generators, tunnel ventilation equipment, and heavy diesel power equipment including mobile cranes and front-end loaders.<br>• Use of temporary barriers near noisy activities. By locating the barriers close enough to the noise source, it is possible to obtain substantial noise attenuation with barriers 10 to 12 feet high even though the residences are 30 to 40 feet higher than the construction site.<br>• Use of partial enclosures around noisy activities. It is sometimes necessary to construct shed-like structures or complete buildings to contain the noise from nighttime activities. | | | | |

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| **Vibration – Operations** | | | | |
| **VibO1** – Use high-resilience track fasteners or a resiliently supported tie system for the Caltrain Downtown Extension for areas projected to exceed vibration criteria, including the following locations: (1) Live/Work condos, 388 Townsend Street (Hubbell an Seventh), (2) San Francisco Residences on Bryant (Harrison Parking Lot Site), (3) Clock Tower Building, and Second Street High Rise and (4) new Marriott Courtyard (Marine Firefighter's Union). | TJPA | During preliminary engineering, final design and construction | TJPA | TJPA to develop locations/use of resilience track fasteners or resiliently supported tie system during preliminary engineering and final design. Review construction documents and inspect installation. Whare applicable, coordinate with CCSF departments with jurisdiction over activities, such as CCSF Department of Building Inspection (DBI) and DPW. |
| **Vibration – Construction** | | | | |
| **VibC1** – Limit or prohibit use of construction techniques that create high vibration levels. At a minimum, processes such as pile driving would be prohibited at distances less than 250 feet from residences. | TJPA | During preliminary engineering, final design and construction | TJPA | TJPA to ensure preliminary design, final design and contract documents preclude use of pile driving equipment within 250 feet of residences. Construction management and inspection will monitor contractors' activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW. |

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| **VibC 2** – Restrict procedures that contractors can use in vibration sensitive areas. (It is often possible to employ alternative techniques that create lower vibration levels. For example, unrestricted pile driving is one activity that has considerable potential for causing annoying vibration. Using the cast-in-drilled-hole piling method instead will eliminate most potential for vibration impact from the piling.) | TJPA | During preliminary engineering, final design and construction | TJPA | TJPA to establish construction vibration design standards during final design. Include provisions in contract documents and monitor contractors' activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW. |
| **VibC 3** – Require vibration monitoring during vibration intensive activities. | TJPA | During construction | TJPA | TJPA to include provisions for vibration monitoring in construction contract documents or perform monitoring under a separate contract. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW. |
| **VibC 4** – Restrict the hours of vibration intensive activities such as pile driving to weekdays during daytime hours. | TJPA | During design and construction | TJPA | TJPA to include provisions in contract documents and monitor contractors' activities to ensure compliance. |
| **VibC 5** – Investigate alternative construction methods and practices to reduce the impacts in coordination with the construction contractor if resident annoyance from vibration becomes a problem. | TJPA | During final design and during construction | TJPA | TJPA to include provisions in contract documents and monitor contractors' activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW. |

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| **VibC 6** – Include specific limits, practices and monitoring and reporting procedures for the use of controlled detonation. Control and monitor use of controlled detonation to avoid damage to existing structures. Include specific limits, practices, and monitoring and reporting procedures within contract documents to ensure that such construction methods, if used, would not exceed safety criteria. | TJPA | During final design and during construction | TJPA | TJPA to establish detailed limits, practices, and monitoring program for controlled detonation during final design. Include provisions in contract documents and monitor contractors' activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW. |
| **Soils/Geology** | | | | |
| **SG 1** – Monitor adjacent buildings for movement, and if movement is detected, take immediate action to control the movement. | TJPA | During construction | TJPA | TJPA to include provisions in contract documents requiring such monitoring and corrective measures and inspect contractors' activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW. |
| **SG 2** – Apply geotechnical and structural engineering principles and conventional construction techniques similar to the design and construction of high-rise buildings and tunnels throughout the downtown area. Apply design measures and utilize pile-supported foundations to mitigate potential settlement of the surface and underground stations. | TJPA | During preliminary engineering and final design | TJPA | TJPA to review design and contract documents to ensure implementation. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW. |
| **SG 3** – Design and construct structural components of the project to resist strong ground motions approximating the maximum anticipated earthquake (0.5g). The cut-and-cover portions will require pile supports to minimize non-seismic settlement in soft compressible sediments (Bay Mud). The underground Caltrain station at Fourth and Townsend will require pile-supported foundations due to the presence of underlying soft sediments. | TJPA | During preliminary engineering, final design and construction | TJPA | TJPA to design structural components to meet seismic standards during preliminary engineering and final design. Review design, contract documents and construction activities to ensure implementation. Where applicable, coordinate with JPB and CCSF departments with jurisdiction |

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| | | | | over activities, such as DBI and DPW. |
| **SG 4** – Underpin existing building, where deemed necessary, to protect existing structures from potential damage that could result from excessive ground movements during construction. Design the tunneling and excavation procedures (and construction sequence), and design of the temporary support system with the objective of controlling ground deformations within small enough levels to avoid damage to adjacent structures. Where the risk of damage to adjacent structures is too great, special measures will be implemented such as: (1) underpinning, (2) ground improvement, and/or (3) strengthening of existing structures to mitigate the risks.<br><br>Underpinning may include internal strengthening of the superstructure, bracing, reinforcing existing foundations, or replacing existing foundations with deep foundations embedded outside the tunnel zone of influence. Alternatives, in lieu of underpinning, involve strengthening the rock between the building and crown of tunnel. Grouting in combination with inclined pin piles can be used not only to strengthen the rock, but also make the rock mass over the tunnel act as a rigid beam, allowing construction of tunnels with no adverse effects on the buildings supported on shallow foundations over the tunnel. | TJPA | During preliminary engineering, final design and construction | TJPA | TJPA to design tunneling, excavation procedures, underpinning, strengthening existing structures or ground improvement to protect existing structures from damage Include provisions in contract documents requiring contractors to implement measures during construction. Monitor construction activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW. |

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| **SG 5** – TJPA shall assure proper design and construction of pile-supported foundations for structures to control potential settlement of the surface. Stability of excavations and resultant impacts on adjacent structures can be controlled within tolerable limits by proper design and implementation of the excavation shoring systems. | TJPA | During preliminary engineering, final design and construction | TJPA | TJPA to ensure foundations and excavation shoring systems are designed and constructed to minimize and control settlement and impacts on adjacent structures. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW. |
| **Utilities** | | | | |
| **Util 1** – Coordinate with utility providers during preliminary engineering, continuing through final design and construction. Utilities would be avoided, relocated, and/or supported as necessary during construction activities to prevent damage to utility systems and to minimize disruption and degradation of utility service to local customers. | TJPA | During preliminary engineering, final design and construction | TJPA | TJPA to identify utilities; design relocations or protection measures where required; and include requirements in contract documents. Monitor construction activities to ensure implementation of all required measures. |
| **Cultural and Historic Resources** | | | | |
| **CH 1** – Comply with the provision of the signed Memorandum of Agreement (MOA) between the Federal Transit Administration, the State Historic Preservation Officer, and the TJPA. | TJPA | During preliminary engineering, final design and construction | TJPA | TJPA will assure compliance with MOA provisions during preliminary engineering, final design and construction, as described below. |

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| **CH 2 – – <u>Professional Qualifications</u>.** Assure all activities regarding history, historic preservation, historic architecture, architectural history, historic and prehistoric archaeology are carried out by or under the direct supervision of persons meeting, at a minimum, the Secretary of the Interior's professional qualifications standards (48 FR 44738-9) (PQS) in these disciplines. Nothing in this stipulation may be interpreted to preclude any signatory or any agent or contractor thereof from using the properly supervised services or persons who do not meet the PQS.<br><br>**<u>Historic Preservation Standards</u>.** Assure all activities regarding history, historic preservation, historic architecture, architectural history, historic and prehistoric archaeology are carried out to reasonably conform to the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716-44740) as well as to applicable standards and guidelines established by SHPO.<br><br>**<u>Curation and Curation Standards.</u>** Ensure that FTA and TJPA shall, to the extent permitted under sections 5097.98 and 5097.991.[sic] of the California Public Resources Code, materials and records resulting from any archaeological treatment or data recovery that may be carried out pursuant to this MOA, are curated in accordance with 36 CFR Part 79. | TJPA | During preliminary engineering, final design and construction | TJPA | Prior to initiation of design and construction activities, TJPA will require submission of and review qualifications of professionals performing the MOA activities to assure that Secretary of Interior standards are met. |
| **CH 3** – Integrate into the design of the new terminal a dedicated space for a permanent interpretive exhibit. The interpretive exhibit will include at a minimum, but is not necessarily limited to: plaques or markers, a mural or other depiction of the historic Transbay Transit Terminal (TTT), ramps, or Key System, or other interpretive material. | TJPA | During preliminary engineering and final design | TJPA | TJPA will include space for interpretive exhibit in terminal during design. Review contract documents and construction submittals and activities to ensure implementation. |

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| **CH 4** – Consult with the State Department of Transportation (Department) regarding the availability of historical documentary materials for the creation of the permanent interpretive display of the history of the original TTT building and its association with the San Francisco- Oakland Bay Bridge. Department will assist TJPA in planning the scope and content of the proposed interpretive exhibit. Invite the Oakland Heritage Alliance, the San Francisco Architectural Heritage, the California State Railroad Museum, and the Western Railway Museum to participate in this consultation. While retaining responsibility for the development of the exhibit, TJPA will jointly consider the Department's and participating invitees' recommendations when finalizing the exhibit design. TJPA will produce, install, and maintain the exhibit. | TJPA | During preliminary engineering and final design | TJPA | TJPA will consult with Department regarding availability of documentary materials. TJPA will invite participation in this review from the other designated parties. TJPA will produce, install, and maintain the exhibit in the new Transbay Terminal. |
| **CH 5** – Consult with the City of Oakland about its possible interest in having a similar interpretive exhibit in the East Bay. If agreement is reached prior to completion of final design of the Transbay Terminal, TJPA will provide and deliver exhibit materials to a venue that is mutually satisfactory to TJPA and the City of Oakland. | TJPA | During preliminary engineering and final design | TJPA | During preliminary engineering and final design, TJPA will consult with City of Oakland regarding its possible interest in establishing an exhibit. TJPA will provide and deliver exhibit materials to a venue in the City of Oakland that is mutually satisfactory to TJPA and the City of Oakland should such an exhibit be developed. |
| **CH 6** – Identify, in consultation with Department, elements of the existing TTT that may be suitable for salvage and interpretive use by museums. Within two years following execution of this MOA by FTA and SHPO, TJPA will offer any elements identified as suitable for salvage and interpretive use to San Francisco Architectural Heritage, the California State Railroad Museum, Sacramento, the Western Railway Museum, the Oakland Museum, and any other interested parties. Remove any elements selected in a manner that minimizes damage and deliver with legal title to the recipient. Items not accepted by interested | TJPA | During preliminary engineering and final design | TJPA | Acceptance of items by interested parties must be completed at least 90 days prior to demolition of the Transbay Terminal |

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| parties for salvage or interpretive use within the time frame specified herein will receive no further consideration. | | | | |
| **CH 7** – Consult with Department and the Oakland Museum about contributing to Department's exhibit and the production of an interpretive video at the Oakland Museum relating to the history and engineering of the major historic state bridges of the San Francisco Bay Area. TJPA will propose contributions to such an exhibit and video that would be related to the history of the TTT, bus ramp loop structures, and the Key System. Items contributed by TJPA to such an exhibit may include photographs, drawings, videotape, models, oral histories, and salvaged components from the TTT. | TJPA | During preliminary engineering and final design | TJPA | TJPA will produce and deliver to the Oakland Museum agreed-upon materials for such an exhibit and interpretive video. |
| **CH 8** – Assist the Oakland Museum by contributing up to $50,000 toward the cost of preparing and presenting the exhibit and preparing an exhibit catalog or related museum publication in conjunction with the exhibit, in a manner and to the extent that is mutually satisfactory to TJPA, Department, and the Oakland Museum. A separate agreement will outline the negotiated financial contributions.<br><br>Work with the Oakland Museum and assist in the preparation of an exhibit and interpretive video if consultation results in agreement between TJPA and the Oakland Museum prior to demolition of the existing TTT. | TJPA | During preliminary engineering and final design | TJPA | TJPA will work with Oakland Museum and assist in the preparation of an exhibit and an interpretive video if consultation results in an agreement between TJPA and Oakland Museum prior to demolition of the existing Transbay Terminal |

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| **CH 9** – Request that SHPO, prior to the start of any work that would have an adverse effeet on eomponents of the Bay Bridge that are historie properties, determine whether these eomponents, including the TTT and associated ramps, have been adequately recorded in existing doeuments. If SHPO determines that, collectively, such doeuments, which inelude the Department's past recordation of a series of remodeling and seismie retrofit project that have oceurred since 1993, adequately document the TTT and ramps, then no further documentation will be necessary. | TJPA | During preliminary engineering and final design | TJPA | TJPA will eonsult with the SHPO regarding adequaey of prior reeordation efforts. |
| Seek, with the assistance of the Department, to obtain the original drawings of the TTT by architeet T. Pflueger. | | | | TJPA will work with Department to seek original drawings of the Transbay Transit Terminal. |
| If SHPO determines that existing doeumentation is adequate, compile such documentation into a comprehensive record. Components to be included in the review of past documentation are:<br>• 425 Mission Transbay Transit Terminal (APN 3719-003, 3720-001, 3721-006);<br>• Upper Deck San Francisco Approaches or North Connector, Bridge #34-116F;<br>• Upper Deek San Franeisco Approaches or Center Ramps, Bridge #34-118L;<br>• San Francisco Approaehes or Lower Deck On-Ramp, Bridge #34-118R;<br>• Transbay Terminal Loop ramp, Bridge #34-119Y; and<br>• Harrison Street over-erossing Bridge #34-120Y. | | | | If SHPO determines that existing doeumentation is adequate, eompile sueh doeumentation into a eomprehensive reeord. |
| Consult further with SHPO, if SHPO determines that existing documentation does not constitute adequate recordation of the Bay Bridge components addressed hereunder. SHPO will determine what level and type of additional doeumentation is neeessary. | | | | If SHPO determines that existing documentation does not eonstitute adequate recordation of the Bay Bridge components, then TJPA and SHPO will consult further and SHPO will determine what level and type of additional documentation is necessary. |
| Provide xerographie copies of this documentation to the SHPO and the Department Headquarters Library, upon a written | | | | |

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| determination by SHPO that all documentation prescribed hereunder is satisfactory, to the History Center at the San Francisco Public Library, San Francisco Architectural Heritage, the Oakland History Room of the Oakland Public Library, the Oakland Museum of California, the Western Railway Museum, and Department District 4 Office. Thereafter, TJPA may proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder. | | | | If no response from SHPO within 45 days of receipt of each submittal of documentation, TJPA may assume that said documentation is adequate and may proceed with the project.<br><br>TJPA will ensure that these records are accepted by SHPO prior to demolition of the TTT and provide copies of the documentation to designated agencies. Then, TJPA will proceed with the aspect of the project that will adversely affect the historic properties documented. |
| **CH 10** – Within 180 days after FTA determines that the Project has been completed, TJPA, in consultation with FTA and SHPO, will re-revaluate the Bay Bridge, a property listed on the NRHP, and determine whether the National Register nomination should be amended or whether the bridge no longer qualifies for listing and should be removed from the National Register. As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR Part 60 (60.14 and 60.15). | TJPA | Within 180 days after FTA determines that the Project has been completed | TJPA | As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR part 60 (60.14 and 60.15). TJPA will coordinate these efforts with the CCSF Planning Department. |
| **CH 11** – Develop and implement measures, in consultation with the owners of historic properties immediately adjoining the construction sites, to protect the contributing elements of the Second and Howard Streets Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District from damage by any aspect of the Project. Such measures will include, but are not necessarily limited to those identified in the MOA.<br><br>The protective measures herein stipulated will be developed and implemented by TJPA prior to the commencement of any aspect | TJPA | During preliminary engineering, final design, and construction | TJPA | TJPA will contact owners of record of historic properties that will be affected (but that will not be acquired and demolished) by the Project. TJPA will provide and review this mitigation monitoring program with the owners via correspondence and/or public and face-to-face meetings. TJPA will coordinate these efforts with the CCSF Planning Department prior to commencement of any aspect of the |

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| of the Project that could have an adverse effect on historic properties immediately adjoining the construction sites herein identified. In addition, TJPA will monitor the effectiveness of the protective measures herein stipulated and will supplement or modify these measures as and where necessary in order to ensure that they are effective. The historic properties covered by the terms of this paragraph are<br>• 589-591 Howard Street/3736-098, NRHP Status: 1D, Contributing Element of Second & Howard District & New Montgomery/Second Street, Const. Date: 1906, Type of Impact: Cut-and-cover construction nearby.<br>• 163 Second Street/3721-048, NRHP Status: 1D, Contributing Element of Second & Howard District & New Montgomery/Second Street, Const. Date: 1907, Type of Impact: Cut-and-cover construction nearby.<br>• 166-78 Townsend Street/3788-012, NRHP Status: 3D Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1910 [1], 1988 [2], Type of Impact: Cut-and-cover construction nearby. Need construction easement.<br>• 640-Second Street/3788-002, NRHP Status: 252, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1926, Type of Impact: Tunnel under or near property<br>• 650 Second Street/3788-049 through 3788-073, NRHP Status: 252, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1922, Type of Impact: Tunnel under or near property<br>• 670-680 Second Street/3788-043, 3788-044, NRHP Status: 252 (670), 3D (680), Contributing Element of Rincon Point/South | | | | project that could have any adverse effect on historic properties immediately adjoining the construction sites herein identified.<br>TJPA will monitor the effectiveness of the protective measures and will supplement or modify these measures as and where necessary in order to ensure that they are effective. |

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| Beach District & South End District, Const. Date: 1913, Type of Impact: Tunnel under or near property<br><br>• 301-321 Brannan Street/3788-037, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1909, Type of Impact: Tunnel under or near property<br><br>• 130 Townsend Street/3788-008, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1910 [1], 1895-6 [2], Type of Impact: Tunnel under or near property<br><br>• 136 Townsend Street/3788-009, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1902 [1], 1913 [2], Type of Impact: Tunnel under or near property<br><br>• 144-46 Townsend Street/3788-009A, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1922, Type of Impact: Tunnel under or near property<br><br>• 148-54 Townsend Street/3788-010, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1922, Type of Impact: Tunnel under or near property<br><br>• 162-164 Townsend Street/3788-081, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1919, Type of Impact: Tunnel under or near property<br><br>Notes: National Register Status Codes are as follows:<br>1 – Listed on the NRPH<br>251 – Determined eligible for listing by the Keeper of the | | | | |

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| Register<br>252 – Determined eligible for listing by the consensus of the SHPO and federal agency<br>1D – Listed on the National Register as a contributor to a district or multi-resource property | | | | |
| **CH 12** –TJPA will take the effect of the Project on the three historic properties listed below into account by recording these properties in accordance with the terms herein set forth. These buildings are:<br>• 191 2nd Street, (APN: 3721-022),<br>• 580-586 Howard Street, (APN: 3721-092 through 3721-106), and<br>• 165-173 2nd Street, (APN: 3721-025)<br>Prior to taking any action that could adversely affect these properties, consult SHPO and SHPO will determine the type and level of recordation that is necessary for these properties. Upon a written determination by SHPO that all documentation prescribed hereunder is complete and satisfactory, submit a copy of this documentation to SHPO, with xerographic copies8 to the History Center at the San Francisco Public Library, San Francisco Architectural Heritage, and the Oakland History Room of the Oakland Public Library. Thereafter, proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder.<br>If SHPO does not respond within 45 days of receipt of each submittal of documentation prescribed herein, assume that SHPO has determined that said documentation is adequate and may proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder. | TJPA | During preliminary engineering and final design | TJPA | TJPA will consult SHPO and SHPO will determine the type of recordation necessary for the properties.<br>TJPA will submit a copy of this documentation to SHPO, upon a written determination by SHPO that all documentation prescribed hereunder is complete and satisfactory, with copies to the designated agencies.<br>If no response from SHPO within 45 days of receipt of each submittal of documentation, then TJPA may proceed with the project. |

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| **CH 13** – Repair, in accordance with the Secretary of the Interior's Standards for Rehabilitation, any damage to contributing elements of the Second and Howard Streets Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District resulting from the Project.<br><br>Photograph the condition of the contributing elements prior to the start of the Project to establish the baseline condition for assessing damage. Consult with property owner(s) about the appropriate level of photographic documentation of building interiors and exteriors. Provide a copy of this photographic documentation to the property owner(s), and retain on file.<br><br>Submit repair plans and specifications to SHPO for review and comment, if repair of inadvertent damage resulting from the Project is necessary, to ensure that the work conforms to the Secretary of the Interior's Standards for Rehabilitation. Consult with SHPO to establish a mutually satisfactory time frame for the SHPO's review. TJPA will carry out any repairs required hereunder in accordance with the comments of SHPO. | TJPA | Prior to, during, and following construction | TJPA | TJPA will repair any damage to contributing elements.<br><br>TJPA will photograph condition of contributing properties prior to the start of the Project to establish the baseline condition for assessing damage. TJPA will consult with property owner(s) about the appropriate level of photographic documentation of building interiors and exteriors, provide a copy of this photographic documentation to the property owner(s), and retain copy on file by TJPA.<br><br>TJPA will submit repair plans and specifications to SHPO for review and comment, if repair of inadvertent damage is necessary, to ensure conformance to the Secretary of the Interior's Standards for Rehabilitation. |
| **CH 14** – Within 180 days after FTA determines that the Project has been completed, TJPA, in consultation with FTA and SHPO, will re-revaluate the Second and Howard Streets Historic District and determine whether the National Register nomination should be amended or whether the district no longer qualifies for listing and should be removed from the National Register. As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR Part 60 (60.14 and 60.15). | TJPA | Within 180 days after FTA determines that the Project has been completed | TJPA | As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR part 60 (60.14 and 60.15). TJPA will coordinate these efforts with the CCSF Planning Department. |

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| **CH 15** – Within 45 days following execution of MOA, consult with FTA, SHPO, JPB and CCSF to initiate the process of determining how archaeological properties that may be affected by the Project will be identified, whether and how the NRHP eligibility of such properties may be addressed, and whether and how the Project's effects, if any, on those archaeological properties that may be considered historic properties for purposes of this MOA, may be taken into account. FTA and TJPA to invite Caltrans to participate in this consultation. Determine the time frame for this consultation with the consulting parties through consensus.<br><br>Consultation will at minimum be informed by, and take into account, the following documents:<br><br>1) Attachment 6, "Standard Treatment of Archaeological Sites: Data Recovery Plan," of the "Programmatic Agreement among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Office, and the California Department of Transportation regarding compliance with Section 106 of the National Historic Preservation Act, as it pertains to the Administration of the Federal Aid Highway Program in California;"<br><br>2) "Archaeological Research Design and Treatment Plan for SF-480 Terminal Separation Rebuild (Praetzellis and Praetzellis, 1993)" and " The San Francisco-Oakland Bay Bridge, West Approach Replacement: Archaeological Research Design and Treatment Plan (Ziesing, 2000);<br><br>3) "Revised Historical Archaeology Research Design for the Central Freeway Replacement Project (Thad M. Van Bueren, Mary Praetzellis, Adrian Praetzellis, Frank Lortie, Brian Ramos, Meg Scantlebury and Judy D. Tordoff)." | TJPA | During preliminary engineering phase | TJPA | SHPO, FTA, SHPO, TJPA, JPB, and CCSF will consult to determine how archaeological properties will be identified, whether and how the NRHP eligibility of such properties may be addressed, and whether and how the Project's effects, if any, on those archaeological properties that may be considered historic properties may be taken into account. Invite Caltrans to participate in this consultation.<br><br>The consultation will take into account the designated documents. |

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| **CH 16** – If the consulting parties agree that a treatment plan for archaeological properties should be prepared, prepare a Treatment Plan for archaeological resources that provides for the identification, evaluation, and treatment of archaeological properties that may be affected by the Project and that conform to the requirements above of item CH13 1) and take into account the information contained in items CH13 2) and CH13 3) and conform to any other standards, documentation, or guidance that the consulting parties may specify.<br><br>If the consulting parties agree that the Treatment Plan will address historic archaeological properties as well as prehistoric archaeological properties, ensure that appropriately qualified historians prepare a historic context(s) that will be used by an interdisciplinary team consisting at a minimum of historians and historic archaeologist.<br><br>The historic context will, at a minimum:<br><br>1) identify significant research themes and topics that relate to the historic period(s) addressed by the historic context(s)<br>2) determine what types of historic archaeological properties, if any, that may usefully and significantly contribute to research themes and topics deemed by the historic context(s) study to be important<br>3) identify the specific components and constituents (features, artifacts, etc., if any, of historic archaeological property types that can factually and directly, contribute data important to our understanding of significant historic research themes and topics<br>4) determine the amount (sample size, etc.) of archaeological excavation and related activity that is needed to provide the range and type of factual data that will contribute to our understanding of significant historic research themes and topics | TJPA | During preliminary engineering | TJPA | TJPA will assure completion of comprehensive treatment plan consistent with the content required in the MOA, if the consulting parties agree that a treatment plan for archaeological properties is to be prepared.<br><br>TJPA shall transmit this plan to the signatories of the MOA.<br><br>TJPA will ensure that appropriately qualified historians prepare a historic context(s) that includes the specified information for use by an interdisciplinary team consisting at a minimum of historians and historic archaeologist, if the consulting parties agree that the Treatment Plan will address historic archaeological properties as well as prehistoric archaeological properties. |

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| Submit the draft Treatment Plan to the other consulting parties for review and comment. The consulting parties have 45 days from receipt of the draft Treatment Plan to comment in writing to FTA and TJPA. Failure of the consulting parties to respond within this time frame shall not preclude FTA and TJPA from finalizing the draft Treatment Plan to their satisfaction.<br><br>Before finalizing the draft Treatment Plan, FTA and TJPA to provide the consulting parties with written documentation indicating whether and how the draft Treatment Plan will be modified.<br><br>Unless any consulting party objects to this documentation in writing to FTA and TJPA within 15 days following receipt, finalize the draft Treatment Plan as deemed appropriate by FTA and TJPA, and proceed to implement the final Treatment Plan. | TJPA | During preliminary engineering phase | TJPA and FTA | TJPA will submit the draft Treatment Plan to the consulting parties for review and comment.<br><br>Before finalizing the draft Treatment Plan, FTA and TJPA will provide the consulting parties whether and how the draft Treatment Plan will be modified.<br><br>TJPA will ensure that the consulting parties have 15 days following receipt of notification of the modifications to comment in writing about the proposed modifications.<br><br>Unless consulting party objects, FTA and TJPA will finalize the draft Treatment Plan as they deem appropriate, and TJPA and FTA will implement the final Treatment Plan. |
| If FTA and TJPA propose to modify the final Treatment Plan, they will notify the consulting parties concurrently in writing about the proposed modifications. The consulting parties will have 15 days from receipt of notification to comment in writing to FTA and TJPA. Failure of the consulting parties to respond within this time frame shall not preclude FTA and TJPA from modifying the final Treatment Plan to their satisfaction.<br><br>Before modifying the final Treatment Plan, FTA and TJPA will provide the consulting parties with written documentation indicating whether and how the final Treatment Plan will be modified. Unless any consulting party objects to this documentation in writing to FTA and TJPA within 15 days following receipt, modify the final Treatment Plan as appropriate, and proceed to implement the modified final Treatment Plan. | TJPA | During preliminary engineering phase | TJPA and FTA | FTA and TJPA will provide the consulting parties whether and how the final Treatment Plan will be modified.<br><br>TJPA will ensure that the consulting parties have 15 days following receipt of notification of the modifications to comment in writing about the proposed modifications.<br><br>Unless consulting party objects, FTA and TJPA will modify the final Treatment Plan as they deem appropriate, and TJPA and FTA will proceed to implement the modified final Treatment Plan. |

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| **CH 17** – 1) Within two years after FTA, in consultation with TJPA, has determined that all fieldwork required by the Treatment Plan has been completed, prepare a draft technical report that documents the results of implementing the Treatment Plan and distributes this draft technical report to the other MOA signatories for review. The reviewing parties will be afforded 60 days following receipt of the draft technical report to submit any written comments to FTA and TJPA. Failure of the reviewing parties to respond within this time frame shall not preclude FTA from authorizing TJPA to revise the draft technical report as FTA and TJPA deem appropriate. | TJPA | Within two years of completed fieldwork | TJPA and FTA | TJPA will prepare a draft technical report that documents the results of implementing the Treatment Plan and distribute this draft technical report to the other MOA signatories for review.<br><br>FTA to authorize TJPA to revise draft as deemed appropriate by FTA and TJPA. |
| FTA will provide the reviewing parties with a written documentation indicating modifications in accordance with any reviewing party comments. Unless the reviewing parties object to this documentation in writing to FTA and TJPA within 30 days following receipt, modify the draft technical report as FTA and TJPA deem appropriate. Thereafter, issue the technical report in final form and distribute this document in accordance with paragraph CH15 2). | | | | FTA will provide the reviewing parties with a written documentation indicating modifications in accordance with any reviewing party comments.<br><br>Unless any reviewing party objects, FTA and TJA to issue technical report in final form and distribute in accordance with paragraph CH15 2). |
| 2) Distribute copies of the final technical report documenting the results of the Treatment Plan implementation to the other signatory parties, to any consulting Native American Tribe if prehistoric, protohistoric or ethnographic period archaeological properties were located and addressed under the Treatment Plan, and to the appropriate California Historical Resources Information Survey (CHRIS) Regional Information Center, subject to the terms of Stipulation IV. E (CH19). | | | | TJPA will distribute copies of the final technical report documenting the results of Treatment Plan implementation to other signatory parties, to any consulting Native American Tribe, as applicable, and to the appropriate CHRIS Regional Information Center. |
| 3) Prepare a written draft document that communicates in lay terms the results of Treatment Plan implementation to members of the interested public. Distribute this written draft document for review and comment concurrently with and in the same manner as that prescribed for the draft written technical report prescribed by paragraph C.1. of this stipulation. If the draft document prescribed hereunder is a publication such as a report or | | | | TJPA will prepare a written draft document that communicates in lay terms the results of Treatment Plan implementation to members of interested public. |

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| brochure, then distribute such publication to the other signatory parties, to any consulting Native American Tribe as applicable, and to any other entity that the signatory parties and, as applicable, any consulting Native American Tribe, through consultation as appropriate, subject to the terms of Stipulation IV.E (CH 19). | | | | |
| 4) Prepare a written annual report describing the status of its efforts to comply with the terms of Stipulations II – IV, inclusive, of this MOA. Prepare the annual report following the end of each fiscal year (July 1 to June 30) that this MOA is in effect and distributed it to all MOA signatories by July 30 of each year until FTA and the SHPO through consultation determine that the requirements of stipulations II – IV, inclusive of this MOA have been satisfactorily completed. | TJPA | During preliminary engineering, final design, and construction | TJPA | TJPA will prepare an annual report describing its efforts to comply with the terms of stipulations II-IV. |
| **CH 18** – If the consulting parties agree that a plan for treatment of archaeological properties will not be prepared, then address any archaeological properties discovered during implementation of any aspect of the Project pursuant to 36 CFR 800.13(b)(3). | TJPA | During construction phase | TJPA | If treatment plan not prepared, TJPA will address any archaeological properties discovered during implementation of any aspect of the Project pursuant to 36 CFR 800.13(b)(3). |
| **CH 19** – The signatories to the MOA acknowledge that historic properties covered by this MOA are subject to the provisions of Section 304 of the National Historic Preservation Act of 1966, as amended, and Section 6254.10 of the California Government Code (Public Records Act), relating to the disclosure of archaeological site information and, having so acknowledged, will ensure that all actions and documentation prescribed by this Agreement are consistent with Section 304 of the National Historic Preservation Act of 1966, as amended, and Section 6254.10 of the California Government Code. | TJPA | During preliminary engineering phase | TJPA | TJPA will acknowledge that historic properties covered by the MOA are subject to the provisions specified in the MOA, relating to the disclosure of archaeological site information. TJPA will ensure that actions and documentation are consistent with same. |

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| **CH 20** – The parties to the MOA agree that Native American burials and related items discovered during implementation of the terms of the MOA and of the Project will be treated in accordance with the requirements of Section 7050.5(b) of the California Health and Safety Code. If, pursuant to Section 7050.5(c) of the California Health and Safety Code, the county coroner/medical examiner determines that the human remains are, or may be of Native American origin, then the discovery shall be treated in accordance with the provisions of Section 5097.98(a)-(d) of the California Public Resources Code. TJPA will ensure that to the extent permitted by applicable law and regulation, the views of any consulting Native American Tribe and the Most Likely Descendant(s) are taken into consideration when decisions are made about the disposition of other Native American archaeological materials and records. | TJPA | Prior to, during, and following construction | TJPA | TJPA agree that Native American burials and related items discovered during implementation of the terms of the MOA and of the Project will be treated in accordance with the requirements specified. If, pursuant to Section 7050.5(c) of the California Health and Safety Code, the county coroner/medical examiner determines that the human remains are, or may be of Native American origin, then the discovery shall be treated in accordance with the provisions specified. TJPA will ensure that to the extent permitted by applicable law and regulation, the views of any consulting Native American Tribe and the Most Likely Descendant(s) are taken into consideration when decisions are made about the disposition of other Native American archaeological materials and records. |
| **Hazardous Materials/Waste – Operations** | | | | |
| **HWO 1** – Construct and operate any Caltrain fueling facility in compliance with local, state and Federal regulations regarding handling and storage of hazardous materials. (Caltrain Joint Powers Board (JPB)/TJPA) | Caltrain Joint Powers Board (JPB) | During construction and operations | TJPA | Review design and contract documents to ensure compliance with all applicable regulations. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. Inspect operations, and comply with all permitting and reporting requirements. |

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| **HWO 2** – Equip diesel fuel pumps with emergency shut-off valves and, in compliance with U.S. EPA requirements, fuel Underground Storage Tanks (USTs) would be equipped with leak detection and monitoring systems. | JPB | During operations | TJPA | Review design and contract documents to ensure compliance with all applicable regulations. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. Inspect operations, and comply with all permitting and reporting requirements |
| **HWO 3** – Employ the use of secondary containment systems for any aboveground storage tanks. | JPB | During operations | TJPA | Secondary containment to be included in facility design and construction and maintained during operations |
| **HWO 4** – Store cleaning solvents in 55-gallon drums, or other appropriate containers, within a bermed area to provide secondary containment. | JPB | During operations | TJPA | Inspect operations, and comply with all permitting and reporting requirements |
| **HWO 5** – Slope paved surfaces within the fueling facility and the solvent storage area to a sump where any spilled liquids could be recovered for proper disposal. | JPB | During construction and operations | TJPA | Sloped paved surfaces and sump to be included in facility design |
| **HWO 6** – Follow California OSHA and local standards for fire protection and prevention for the handling and storage of fuels and solvents. | JPB | During operations | TJPA | Review design and contract documents to ensure compliance with all applicable regulations. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. Inspect operations, and comply with all permitting and reporting requirements |

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| **HWO 7** – Prepare a Hazardous Materials Management/Business Plan and file with the CCSF Department of Public Health. | JPB | During final design | TJPA | JPB to prepare and TJPA to file Hazardous Materials Management/ Business Plan with CCSF Department of Public Health (DPH) |
| **Hazardous Materials/Waste – Construction** | | | | |
| **HMC 1** – Follow California OSHA and local standards for fire protection and prevention. Handling and storage of fuels and other flammable materials during construction will conform to these requirements, which include appropriate storage of flammable liquids and prohibition of open flames within 50 feet of flammable storage areas. | TJPA | During construction | TJPA | Review design and contract documents to ensure compliance with all applicable regulations. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. |
| **HMC 2** – Perform detailed investigations of the potential presence of contaminants in soil and groundwater prior to construction, using conventional drilling, sampling, and chemical testing methods. Based on the chemical test results, a mitigation plan will be developed to establish guidelines for the disposal of contaminated soil and discharge of contaminated dewatering effluent, and to generate data to address potential human health and safety issues that may arise as a result of contact with contaminated soil or groundwater during construction. The investigation and mitigation plan will follow the requirements of the City and County of San Francisco's Article 22A in the appropriate areas along the alignment.<br><br>With construction projects of this nature and magnitude, there are typically two different management strategies that can be employed to address contaminated soil handling and disposal issues. Contaminated soil can be excavated and stockpiled at a centralized location and subsequently sampled and analyzed for disposal profiling purposes in accordance with the requirements of the candidate disposal landfill. Alternatively, soil profiling for | TJPA | During construction | TJPA | Review design and contract documents to ensure compliance with all applicable regulations. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH and DPW. |

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| disposal purposes can be done in-situ so when soil is excavated it is loaded directly on to trucks and hauled to the appropriate landfill facility for disposal based on the in-situ profiling results. A project of this nature could also combine both strategies. | | | | |
| **HMC 3** – Cover with plastic sheeting soils removed during excavation and grading activities that remain at a centralized location for an extended period of time to prevent the generation of fugitive dust emissions that migrate offsite. | TJPA | During construction | TJPA | Review design and contract documents to ensure compliance. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. |
| **HMC 4** – Use a licensed waste hauler, applying appropriate manifests or bill of lading procedures, as required to haul soil for disposal at a landfill or recycling facility. | TJPA | During construction | TJPA | Review design and contract documents to ensure compliance. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. |
| **HMC 5** – Use chemical test results for groundwater samples along the alignment to obtain a Batch Discharge Permit under Article 4.1 of the San Francisco Department of Public Works as well as to evaluate requirements for pretreatment prior to discharge to the sanitary sewer. Effluent produced during the dewatering of excavations will be collected in onsite storage tanks and periodically tested, as required under discharge permit requirements, for potential contamination to confirm the need for any treatment prior to discharge.<br><br>If required, treatment may include:<br><br>- Settling to allow particulate matter (total suspended solids) to settle out of the effluent in order to reduce the sediment load as well as reduce elevated metal and other contaminant concentrations that may be associated with suspended | TJPA | During construction | TJPA | Review design and contract documents to ensure compliance. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH and DPW. |

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| sediments; and/or<br>○ Construction of a small-scale batch waste water treatment system to remove dissolved contaminants (mainly organic constituents such as petroleum hydrocarbons [gas, diesel, and oils], BTEX, and VOCs) from the dewatering effluent prior to discharge to the sanitary sewer. A treatment system would also likely employ the use of filtration to remove suspended solids. | | | | |
| **HMC 6** – Develop a detailed mitigation plan for the handling of potentially contaminated soil and groundwater prior to starting project construction. | TJPA | During final design | TJPA | Review detailed mitigation plan, include provisions in contract documents and inspect construction to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH and DPW. Obtain all applicable permits |
| **HMC 7** – Design dewatering systems to minimize downward migration of contaminants that can result from lowering the water table if necessary based on environmental conditions. As necessary, shallow soils with detected contamination would be dewatered first using wells screened only in those soils. Dewatering of deeper soils would then be performed using wells screened only in the zone to be dewatered. Dewatering wells would be installed using drilling methods that prohibit shallow contaminated soils from being carried deeper into the boreholes. | TJPA | During final design and construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH and DPW |
| **HMC 8** – Require that workers performing activities on site that may involve contact with contaminated soil or groundwater have appropriate health and safety training in accordance with 29 CFR 1910.120.<br><br>A Worker Health and Safety Plan (HSP) will be developed for the project and monitored for the implementation of the plan on a day-to-day basis by a Certified Industrial Hygienist (CIH). The | TJPA | During construction | TJPA | Provide health-and-safety training prior to start of and at timely intervals during construction. Include requirements in contract documents and monitor construction activities to ensure compliance. |

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| HSP will include provisions for:<br>• Conducting preliminary site investigations and analysis of potential job hazards;<br>• Personnel protective equipment;<br>• Safe work practices;<br>• Site control;<br>• Exposure monitoring;<br>• Decontamination procedures; and<br>• Emergency response actions.<br><br>The HSP will specify mitigation of potential worker and public exposure to airborne contaminant migration by incorporating dust suppression techniques in construction procedures. The plan will also specify mitigation of worker and environmental exposure to contaminant migration via surface water runoff pathways by implementation of comprehensive measures to control drainage from excavations and saturated materials excavated during construction. | | | | |
| **HMC 9** – Review existing asbestos surveys, abatement reports, and supplemental asbestos surveys, as warranted. Perform an asbestos survey for buildings to be demolished, as required. Asbestos-containing building materials (ACM) will require abatement prior to building demolition. Removal and disposal of ACM will be performed in accordance with applicable local, state, and federal regulations. | TJPA | During preliminary engineering, final design and construction phases | TJPA | Determine extent of ACM throughout project site. Perform abatement work. prior to demolition. Include all regulatory requirements in contract documents and inspect construction to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH. Obtain all applicable permits. |

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| **HMC 10** – Perform a lead-based paint survey for buildings to be demolished to determine areas where lead-based paint is present and the possible need for abatement prior to demolition. | TJPA | During preliminary engineering prior to building demolitions | TJPA | Determine extent of lead contamination throughout project site. Perform abatement work prior to demolition if necessary. Include all regulatory requirements in contract documents and inspect construction to insure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH. Obtain all applicable permits. |
| **Pedestrians** | | | | |
| **Ped 1** – Use future construction or redevelopment as opportunities to increase building set-backs thereby increasing sidewalk widths. Particular areas where such widening is most needed include:<br>• The southeast corner of Fremont and Mission streets,<br>• The northeast corner of First and Mission streets,<br>• The north side of Mission Street between First and Fremont, and<br>• Sidewalks south of Howard Street along Folsom, First, Fremont and Beale that are less than 10 feet wide. | Agency and CCSF | During future project reviews in Transbay Terminal area | Agency and CCSF | TJPA will forward guidance to Agency, CCSF Planning Department and DPW. |
| **Ped 2** – Eliminate or reduce sidewalk street furniture such as newspaper boxes and magazine racks in the immediate Transbay Terminal area on corners. | Agency and CCSF | Prior to opening of new Transbay Terminal | Agency and CCSF | TJPA will forward guidance to Agency, CCSF Planning Department and DPW. |
| **Ped 3** – Retime traffic light signalization. This could improve pedestrian levels of service at each of the intersections studies that fall into LOS F. | CCSF | Prior to opening of new Transbay Terminal | CCSF | TJPA will forward guidance to CCSF DPT. |

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| **Ped 4** – Provide crosswalk signalization at intersections where they do not exist already, such as Folsom and Beale streets. | CCSF | Prior to opening of new Transbay Terminal | CCSF | TJPA will forward guidance to CCSF DPT. |
| **Ped 5** – Provide cross-walk count-down signals at intersections and cross-walks immediately surrounding the new Transbay Terminal. | CCSF | Prior to opening of new Transbay Terminal | CCSF | TJPA will forward guidance to CCSF DPT. |
| **Ped 6** – Ensure that Transbay Terminal design increases corner and sidewalk widths at the four intersections immediately surrounding the Transbay Terminal. | TJPA and CCSF, DPW | During Transbay Terminal design phase | TJPA | TJPA and CCSF DPW, where applicable, to include sidewalk width expansion during preliminary and final design of new Transbay Terminal |
| **Ped 7** – Provide lights within crosswalks to warn when pedestrians are present in the crosswalk, such as at the cross-walk associated with the mid-block bus loading area. | TJPA | Prior to opening of new Transbay Terminal | TJPA | TJPA to work with CCSF DPT to install cross-walk warnings |
| **Pre-Construction Activities** | | | | |
| **PC 1** – Complete a pre-construction building structural survey to determine the integrity of existing buildings adjacent to and over the proposed Caltrain Downtown Extension. Use this survey to finalize detailed construction techniques along the alignment and as the baseline for monitoring construction impacts during and following construction. | TJPA | Prior to preliminary engineering, final design and construction | TJPA | TJPA to perform building surveys during preliminary engineering. TJPA to include measures to protect existing buildings in final design and construction documents.<br><br>TJPA to review design submittals, contract documents and construction activities to ensure implementation |

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| **PC 2** – Contact and interview individual businesses along the Caltrain Downtown Extension alignment to gather information and develop an understanding of how these businesses carry out their work. This survey will identify business usage, delivery/shipping patterns, and critical times of the day or year for business activities. Use this information to assist in: (a) the identification of possible techniques during construction to maintain critical business activities, (b) analyze alternative access routes for customers and deliveries to businesses, (c) develop traffic control and detour plans, and (d) finalize construction practices. (TJPA) | TJPA | During preliminary engineering, final design and construction | TJPA | TJPA to perform business activity survey during preliminary engineering. TJPA to include measures to maintain business activities and access in final design and construction documents.<br><br>TJPA to review design submittals, contract documents and construction activities to ensure implementation. |
| **PC 3** – Complete detailed geotechnical investigation, including additional sampling (drilling and core samples) and analyses of subsurface soil/rock conditions. Use this information to design the excavation and its support system to be used in the retained cut, cut-and-cover, and tunnel portions of the Caltrain Downtown Extension. | TJPA | During preliminary engineering and final design | TJPA | TJPA to obtain necessary permits from CCSF prior to performing drilling. TJPA to perform detailed geotechnical investigation during preliminary engineering.<br><br>TJPA to review design submittals, contract documents and construction activities to ensure proper utilization of information obtained during investigation. |
| **PC 4** – Establish community construction information/outreach program to provide on-going dialogue between the TJPA and the affected community regarding construction impacts and possible mitigation/solutions. Include dedicated personnel for an outreach office in the construction area to deal with construction coordination. | TJPA | During construction | TJPA | TJPA to establish program during final design prior to construction. |

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| **PC 5** – Establish site and field offices located along the Caltrain Downtown Extension alignment. Field office staff, in conjunction with other staff, will:<br>• Provide the community and businesses with a physical location where information pertaining to construction can be exchanged,<br>• Enable TJPA and JPB to better understand community/business needs during the construction period,<br>• Allow TJPA and JPB to participate in local events in an effort to promote public awareness of the project,<br>• Manage construction-related matters pertaining to the public,<br>• Notify property owners, residences, and businesses of major construction activities (e.g., utility relocation/disruption and milestones, re-routing of delivery trucks),<br>• Provide literature to the public and press,<br>• Promote and provide presentations on the project via a Speakers Bureau,<br>• Respond to phone inquires,<br>• Coordinate business outreach programs,<br>• Schedule promotional displays, and<br>• Participate in community committees. | TJPA and JPB | During construction | TJPA | TJPA to establish program during final design and continue during construction. |

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| **PC 6** – Implement an information phone line to provide community members and businesses the opportunity to express their views regarding construction. Review calls received and, as appropriate, forward the message to the necessary party for action (e.g., utility company, fire department, the Resident Engineer in charge of construction operations). Information available from the telephone line will include current project schedule, dates for upcoming community meetings, notice of construction impacts, individual problem solving, construction complaints and general information. Phone service would be provided in English, Cantonese, and Spanish and would be operated on a 24-hour basis. | TJPA | During construction | | TJPA to establish informational "Hot Line" during final design and continue during construction. |
| **PC 7** – Develop traffic management plans. Traffic management plans to maintain access to all businesses will be prepared for areas affected by surface or cut-and-cover construction. In addition, daily cleaning of work areas would be performed by contractors for the duration of the construction period. Provisions would be contained in construction contracts to require the maintenance of driveway access to businesses to the extent feasible. | TJPA | During preliminary engineering, final design and construction | TJPA | TJPA to forward traffic management plans to CCSF DPT for review and approval. Include all requirements in construction documents and inspect implementation during construction. |

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| **General Construction Measures** | | | | |
| **GC 1** – Disseminate information to community in a timely manner regarding anticipated construction activities. | TJPA | During construction | TJPA | TJPA to initiate program during final design and continue during construction. |
| **GC 2** – Provide signage. Work with establishments affected by construction activities to develop appropriate signage for display that directs both pedestrian and vehicular traffic to businesses via alternate routes. | TJPA | Prior to and during construction | TJPA | TJPA to initiate signage program during final design and monitor contractors' installation during construction. |
| **GC 3** – Install level deck. Install decking at the cut-and-cover sections to be flush with the existing street or sidewalk levels. | TJPA | During construction | TJPA | TJPA to design flush decking during preliminary and final design, include in construction documents and ensure installation during construction. |
| **GC 4** – Provide for efficient sidewalk design and maintenance. Wherever feasible, maintain sidewalks at the existing width during construction. Where a sidewalk must be temporarily narrowed during construction (e.g., deck installation), restore it to its original width during the majority of construction period. (In some places, this may require placing the temporary sidewalk on the deck.) Each sidewalk design should be of good quality and approved by the Resident Engineer prior to construction. Handicapped access will be maintained during construction where feasible. | TJPA | During preliminary engineering and construction | TJPA | TJPA to work with CCSF DPW on design of sidewalk plans during preliminary and final design and ensure installation during construction. |
| **GC 5** – Provide construction site fencing of good quality, capable of supporting the accidental application of the weight of an adult without collapse or major deformation. Where covered walkways or other solid surface fencing is installed, establish a program to allow for art work (e.g., by local students) on the surface(s). | TJPA | During design and construction | TJPA | TJPA to work with CCSF DPW, incorporate requirements in construction documents and inspect installation during construction |

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| **Air Emissions – Construction** | | | | |
| **AC 1** – Assure that, as part of the contract provisions, the project contractor is required to implement the measures below at all project construction sites. | TJPA | During development of contract documents | TJPA | Include requirement in contract documents. |
| **AC 2** – Water all active construction areas at least twice daily. Ordinance 175-91, passed by the San Francisco Board of Supervisors on May 6, 1991, requires that non-potable water be used for dust control activities; therefore, the project contractor would be required to obtain reclaimed water from the City's Clean Water Program or other appropriate sources. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **AC 3** – Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **AC 4** – Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **AC 5** – Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **AC 6** – Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **AC 7** – Install sandbags or other erosion control measures to prevent silt runoff to public roadways. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **AC 8** – Replant vegetation in disturbed areas as quickly as possible. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |

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| **AC 9** – Minimize use of on-site diesel construction equipment, particularly unnecessary idling. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **AC 10** – Shut off construction equipment to reduce idling when not in direct use. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **AC 11** – Where feasible, replace diesel equipment with electrically powered machinery. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **AC 12** – Locate diesel engines, motors, or equipment as far away as possible from existing residential areas. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance |
| **AC 13** – Properly tune and maintain all diesel power equipment. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **AC 14** – Suspend grading operations during first and second stage smog alerts, and during high winds, i.e., greater than 25 miles per hour. | TJPA | During and following construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **AC 15** – Upon completion of the construction phase, buildings with visible signs of dirt and debris from the construction site shall be power washed and/or painted (given that permission is obtained from the property owner to gain access to and wash the property with no fee charged by the owner). | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |
| **Visual/Aesthetics - Construction** | | | | |
| **VA 1** – Assure that construction crews working at night direct any artificial lighting onto the work site in order to minimize "spill over" light or glare effects on adjacent areas. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |

| MITIGATION MEASURE | Responsibility for Implementation | Mitigation Schedule | Monitoring Responsibility | Monitoring Actions/Schedule |
|---|---|---|---|---|
| **VA 2** – Assure that contractors make all efforts possible to minimize specific aesthetic and visual effects of construction identified by neighborhood businesses and residents. | TJPA | During construction | TJPA | Include requirements in contract documents and monitor construction activities to ensure compliance. |

Exhibit 8

# Memorandum of Agreement

Between the

## Federal Transit Administration, and the California State Historic Preservation Officer

Regarding the

## Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project in San Francisco County, California

**WHEREAS**, the Federal Transit Administration (FTA) may assist the Transbay Joint Powers Authority (TJPA), the City and County of San Francisco (CCSF), the Peninsula Corridor Joint Powers Board (JPB), and the San Francisco Redevelopment Agency (SFRA) with construction of a new multi-modal Terminal (Terminal) on the site of the present Transbay Transit Terminal (TTT), extension of the Peninsula Corridor Service (Caltrain) from its current San Francisco terminus at Fourth and Townsend Streets to a new underground terminus beneath the new Terminal, and establishment of a Redevelopment Area Plan with related development projects, including transit-oriented development on publicly-owned land in the vicinity of the new multi-modal Terminal (Undertaking); and

**WHEREAS**, on March 28, 2003, TJPA selected a Locally Preferred Alternative (LPA) for the Undertaking that includes the West Ramp Transbay Terminal Alternative, Full Build Redevelopment Alternative, and Second-to-Main Tunneling Alternative; and

**WHEREAS**, TJPA, as a Responsible Agency, intends to become the project sponsor, a grantee for federal grant receipt purposes, and the recipient of any FTA assistance for the Undertaking; and

**WHEREAS**, the California Department of Transportation (Department) has indicated that it will transfer to TJPA title to the historic property known as the TTT, which is a component of the San Francisco – Oakland Bay Bridge (Bay Bridge), a multi-component structure that is listed on the National Register of Historic Places (NRHP), and that such transfer of title will occur after the Department has received satisfactory proof that FTA has issued a Record of Decision pursuant to NEPA for construction of the Undertaking; and

**WHEREAS**, FTA, in consultation with the California State Historic Preservation Officer (SHPO), has determined that the Undertaking will adversely affect properties listed or eligible for listing in the NRHP (historic properties), including components of the Bay Bridge and the Second and Howard Streets Historic District, and may affect archaeological properties that have not yet been identified; and

**WHEREAS**, the Bay Bridge East Span Seismic Safety Project in San Francisco and Alameda counties is a separate undertaking from the subject Undertaking; and

**WHEREAS**, FTA has consulted with SHPO in accordance with 36 CFR Part 800, regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. 470f), and has notified the Advisory Council on Historic Preservation (ACHP) of the adverse effect finding pursuant to 36 CFR §800.6 (a) (1); and

**WHEREAS**, FTA, TJPA, CCSF, JPB, SFRA have consulted with the Department; the City of Oakland, the San Francisco Architectural Heritage; the San Francisco Planning & Urban Research Association (SPUR); the National Park Service (Western Regional Office); the National Trust for Historic

Preservation; the American Institute of Architects Preservation Committee; San Francisco Beautiful; Transbay Citizens' Advisory Committee; the Oakland Heritage Alliance; the San Francisco Landmarks Preservation Advisory Board; and San Francisco Tomorrow, regarding the Undertaking and its effects on historic properties, and have taken all comments received from these parties into account;

**NOW, THEREFORE**, FTA and SHPO agree that if the Undertaking proceeds with FTA assistance, the Undertaking shall be implemented in accordance with the following stipulations in order to take into account the effects of the Undertaking on historic properties, and further agree that these stipulations shall govern the Undertaking and all of its parts until this Memorandum of Agreement (MOA) expires or is terminated.

## STIPULATIONS

If FTA provides funding assistance or a loan guarantee for the Undertaking, FTA will ensure that the following stipulations, which are applicable to the Locally Preferred Alternative (LPA), are implemented:

### I. Professional Standards

#### A. Professional Qualifications

All activities regarding history, historic preservation, historic architecture, architectural history, historic and prehistoric archaeology, that are carried out pursuant to this MOA will be carried out by or under the direct supervision of persons meeting, at a minimum, the Secretary of the Interior's professional qualifications standards (48 FR 44738-9) (PQS) in these disciplines. However, nothing in this stipulation may be interpreted to preclude any signatory or any agent or contractor thereof from using the properly supervised services of persons who do not meet the PQS.

#### B. Historic Preservation Standards

All activities regarding history, historic preservation, historic architecture, architectural history, historic and prehistoric archaeology that are carried out pursuant to this MOA shall reasonably conform to the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716-44740) as well as to applicable standards and guidelines established by SHPO.

#### C. Curation and Curation Standards.

FTA and TJPA shall ensure that, to the extent permitted under §§ 5097.98 and 5097.991. of the California Public Resources Code, materials and records resulting from any archaeological treatment or data recovery that may be carried out pursuant to this MOA, are curated in accordance with 36 CFR Part 79.

### II. Mitigation of Effects on Components of the San Francisco-Oakland Bay Bridge (Bay Bridge)

#### A. Salvage

TJPA, in consultation with the Department, will identify elements of the existing TTT that may be suitable for salvage and interpretive use by museums. Within two years following execution of this MOA by FTA and SHPO, TJPA will offer any elements identified as suitable for salvage and interpretive use to San Francisco Architectural Heritage, the California State

Railroad Museum, Sacramento, the Western Railway Museum, the Oakland Museum, and any other interested parties. Interested parties must accept these elements at least 90 days prior to demolition of the TTT. TJPA will remove any elements selected in a manner that minimizes damage and will deliver them with legal title to the recipient. Items not accepted by interested parties for salvage or interpretive use within the time frame specified herein will receive no further consideration under this MOA.

**B. Permanent Interpretive Exhibit at the Terminal**

TJPA will direct the design and engineering team for the Undertaking to integrate into the design of the new Terminal a dedicated space for an interpretive exhibit. The interpretive exhibit will include at a minimum, but is not necessarily limited to: plaques or markers, a mural or other depiction of the historic TTT, ramps, or Key System, or other interpretive material.

TJPA will consult with the Department regarding the availability of historical documentary materials for the creation of the permanent interpretive display of the history of the original TTT and its association with the San Francisco-Oakland Bay Bridge.

The Department will assist TJPA in planning the scope and content of the proposed interpretive exhibit. In addition, TJPA will invite the Oakland Heritage Alliance, San Francisco Architectural Heritage, the California State Railroad Museum, and the Western Railway Museum to participate. TJPA, while retaining responsibility for the development of the exhibit, will consider, jointly with the Department, the participating invitees' recommendations when finalizing the exhibit design. TJPA will produce, install, and maintain the exhibit.

TJPA will also consult with the City of Oakland about its possible interest in having a similar interpretive exhibit in the East Bay. If agreement is reached prior to completion of final design of the Terminal, TJPA will provide and deliver exhibit materials to a venue that is mutually satisfactory to TJPA and the City of Oakland.

**C. Oakland Museum of California Exhibit**

TJPA will consult with the Department and the Oakland Museum about contributing to the Department's exhibit and the production of an interpretive video at the Oakland Museum relating to the history and engineering of the major historic state bridges of the San Francisco Bay Area. TJPA will propose contributions to such an exhibit and video that would be related to the history of the TTT, bus ramp loop structures, and the Key System. Items contributed by TJPA to such an exhibit may include photographs, drawings, videotape, models, oral histories, and salvaged components from the TTT. In addition, TJPA will assist the Oakland Museum by contributing up to $50,000 toward the cost of preparing and presenting the exhibit and preparing an exhibit catalog or related museum publication in conjunction with the exhibit, in a manner and to an extent that is mutually satisfactory to TJPA, the Department, and the Oakland Museum. A separate agreement will outline the negotiated financial contributions.

TJPA will work with the Oakland Museum and assist in the preparation of an exhibit and interpretive video if consultation results in agreement between TJPA and the Oakland Museum prior to demolition of the existing TTT.

### D. Documentation

Prior to the start of any work that would have an adverse effect on components of the Bay Bridge that are historic properties, TJPA will request SHPO to determine whether these components, including the TTT and associated ramps, have been adequately recorded in existing documents. If SHPO determines that collectively, such documents, which include the Department's past recordation of a series of remodeling and seismic retrofit projects that have occurred since 1993, adequately document the TTT and ramps, then no further documentation will be necessary. In addition, TJPA, assisted by the Department, will seek to obtain the original drawings of the TTT by architect T. Pflueger. If SHPO determines that existing documentation is adequate, then TJPA will compile such documentation into a comprehensive record. Components to be included in the review of past documentation are:

- 425 Mission Transbay Transit Terminal (APN 3719-003, 3720-001, 3721-006),
- Upper Deck San Francisco Approaches or North Connector, Bridge #34-116F,
- Upper Deck San Francisco Approaches or Center Ramps, Bridge #34-118L,
- San Francisco Approaches or Lower Deck On-Ramp, Bridge #34-118R,
- Transbay Terminal Loop ramp, Bridge #34-119Y, and
- Harrison Street over-crossing, Bridge #34-120Y.

If SHPO determines that existing documentation does not constitute adequate recordation of the Bay Bridge components addressed hereunder, then TJPA and SHPO will consult further and SHPO will determine what level and type of additional documentation is necessary. Upon a written determination by SHPO that all documentation prescribed hereunder is satisfactory, TJPA will provide copies of this documentation to SHPO and the Department Headquarters Library, with xerographic copies to the History Center at the San Francisco Public Library, San Francisco Architectural Heritage, the Oakland History Room of the Oakland Public Library, the Oakland Museum of California, the Western Railway Museum, and Department District 4 Office. Thereafter, TJPA may proceed with that aspect of the Undertaking that will adversely affect the historic properties documented hereunder.

If SHPO does not respond within 45 days of receipt of each submittal of documentation prescribed herein, TJPA may assume that SHPO has determined that said documentation is adequate and may proceed with that aspect of the Undertaking that will adversely affect the historic properties documented hereunder.

## III. Mitigation of Effects on Second and Howard Streets Historic District and Protective Measures for Rincon Point/South Beach Historic Warehouse Industrial District

### A. Protective Measures

TJPA, in consultation with the owners of historic properties immediately adjoining the construction sites. will develop and implement measures to protect the contributing elements of the Second and Howard Streets Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District from damage by any aspect of the Undertaking. Such measures will include, but are not necessarily limited to, those identified in Appendix A to this MOA. The protective measures herein stipulated will be developed and implemented by TJPA prior to the commencement of any aspect of the Undertaking that could have an adverse effect on historic properties immediately adjoining the construction sites herein identified. In addition, TJPA will monitor the effectiveness of the protective measures herein stipulated and will supplement or modify these measures as and where necessary in order to ensure that they are effective. The historic properties covered by the terms of this paragraph are shown in the following table.

| Affected Historic Properties During construction | | | | |
|---|---|---|---|---|
| **Address/ Assessors Parcel Number** | **NRHP Status** | **Contributing *Element of*** | **Const. Date** | **Type of Impact** |
| *589-591 Howard Street / 3736-098* | *1D* | Second & Howard District & New Montgomery/ Second Street | *1906* | *Cut-and-cover construction nearby* |
| *163 Second Street / 3721-048* | *1D* | | *1907* | |
| *166-78 Townsend Street / 3788-012* | *3D* | *Rincon Point/South Beach District & South End District.* | *1910 [1] 1888[2]* | *Cut-and cover Construction nearby. Need construction easement* |
| 640 Second Street / 3788-002 | *2S2* | Rincon Point/South Beach District & South End District. | *1926* | Tunnel under or near property |
| 650 Second Street / 3788-049 *through 3788-073* | *2S2* | | 1922 | |
| 670-680 Second Street / 3788-043, 3788-044 | *2S2 (670), 3D (680)* | | 1913 | |
| 301-321 Brannan Street / 3788-037 | 3D | | 1909 | |
| 130 Townsend Street / 3788-008 | 3D | | 1910 [1] 1895-6 [2] | |
| 136 Townsend Street / 3788-009 | 3D | | 1902 [1] 1913 [2] | |
| 144-46 Townsend Street / 3788-009A | 3D | | 1922 | |
| 148-54 Townsend Street / 3788-010 | 3D | | 1922 | |
| 162-164 Townsend Street / 3788-*081* | 3D | | 1919 | |

**Notes:** National Register Status Codes are as follows:
*1 Listed on the NRHP*
2S1 Determined eligible for listing by the Keeper of the Register
2S2 Determined eligible for listing by consensus of the SHPO and a federal agency.
1D Listed on National Register as a contributor to a district or multi-resource property
2D2 Determined eligible as a contributor by consensus determination
3D Appears eligible as a contributor to a fully documented district
[1] Caltrans, 1983, [2] Corbett and Bradley, 1996
**Source:** JRP Historical Consulting, Parsons Transportation Group, 2001.

## B. Documentation

TJPA will take the effect of the Undertaking on the three historic properties listed below into account by recording these properties in accordance with the terms herein set forth. These properties are:

- 191 2nd Street, (APN: 3721-022),
- 580-586 Howard Street, (APN: 3721-092 through 3721-106), and
- 165-173 2nd Street, (APN: 3721-025).

Prior to taking any action that could adversely affect these properties, TJPA will consult SHPO and SHPO will determine the type and level of recordation that is necessary for these properties. Upon a written determination by SHPO that all documentation prescribed hereunder is complete and satisfactory, TJPA will submit a copy of this documentation to SHPO, with xerographic copies to the History Center at the San Francisco Public Library, San Francisco Architectural Heritage, and the Oakland History Room of the Oakland Public Library. Thereafter, TJPA may proceed with that aspect of the Undertaking that will adversely affect the historic properties documented hereunder.

If SHPO does not respond within 45 days of receipt of each submittal of documentation for prescribed herein, TJPA may assume that SHPO has determined that said documentation is adequate and may proceed with that aspect of the Undertaking that will adversely affect the historic properties documented hereunder.

### C. Repair of Inadvertent Damage

TJPA will ensure that any damage to contributing elements of the Second and Howard Streets Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District resulting from the Undertaking will be repaired by TJPA in accordance with the Secretary of the Interior's Standards for Rehabilitation. The condition of the contributing elements will be photographed by TJPA prior to the start of the Undertaking to establish the baseline condition for assessing any damage. To document these existing conditions, TJPA will consult with property owner(s) about the appropriate level of photographic documentation of building interiors and exteriors. A copy of this photographic documentation will be provided to the property owner(s), and will be retained on file by TJPA. If repair of inadvertent damage resulting from the Undertaking is necessary, TJPA will submit repair plans and specifications to SHPO for review and comment to ensure that the work conforms to the Secretary of the Interior's Standards for Rehabilitation. TJPA and SHPO will consult to establish a mutually satisfactory time frame for the SHPO's review. TJPA will carry out any repairs required hereunder in accordance with the comments of SHPO.

## IV. Consideration of Potential Effects on and Prospective Development and Implementation of a Treatment Plan for Archaeological Properties

### A. Consultation

Within 45 days following execution of this MOA by FTA and SHPO, FTA, SHPO, TJPA, JPB and CCSF will consult to initiate the process of determining how archaeological properties that may be affected by the Undertaking will be identified, whether and how the NRHP eligibility of such properties may be addressed, and whether and how the Undertaking's effects, if any, on those archaeological properties that may be considered historic properties for purposes of this MOA, may be taken into account. FTA and TJPA shall invite Caltrans to participate in this consultation. The time frame for this consultation shall be determined by the consulting parties through consensus. The consultation herein prescribed will at a minimum be informed by, and take into account, the following documents:

1. Attachment 6, "Standard Treatment of Archaeological Sites: Data Recovery Plan", of the "Programmatic Agreement among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Office, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as it pertains to the Administration of the Federal Aid Highway Program in California."

2. "Archaeological Research Design and Treatment Plan for SF-480 Terminal Separation Rebuild (Praetzellis and Praetzellis, 1993)" and "The San Francisco-Oakland Bay Bridge, West Approach Replacement: Archaeological Research Design and Treatment Plan (Ziesing, 2000)".

3. "Revised Historical Archaeology Research Design for the Central Freeway Replacement Project (Thad M. Van Bueren, Mary Praetzellis, Adrian Praetzellis, Frank Lortie, Brian Ramos, Meg Scantlebury and Judy D. Tordoff)."

**B. Treatment Plan**

If the consulting parties agree that a plan for treatment of archaeological properties (Treatment Plan) should be prepared, then TJPA will prepare a Treatment Plan that provides for the identification, evaluation and treatment of archaeological properties that may be affected by the Undertaking. The Treatment Plan shall conform to the requirements of item 1., above, of this stipulation, take into account the information contained in items 2. and 3., above, of this stipulation, and conform to any other standards, documentation, or guidance that the consulting parties may specify. If the consulting parties agree that the Treatment Plan will address historic archaeological properties as well as prehistoric archaeological properties, then with respect to consideration of historic archaeological properties, TJPA shall ensure that appropriately qualified historians prepare a historic context(s) that will be used by an interdisciplinary team consisting at a minimum, of historians and historic archaeologists, to:

1. Identify any significant research themes and topics that relate to the historic period(s) addressed by the historic context(s);

2. Determine what types of historic archaeological properties, if any, may usefully and significantly contribute to research themes and topics deemed by the historic context(s) study to be important;

3. Identify the specific components and constituents (features, artifacts, etc.), if any, of historic archaeological property types that can factually and directly, rather than speculatively, contribute data important to our understanding of significant historic research themes and topics;

4. Determine the amount (sample size, etc.) of archaeological excavation and related activity that is needed to provide the range and type of factual data that will contribute to our understanding of significant historic research themes and topics.

Upon completion, TJPA, on behalf of FTA, will submit the draft Treatment Plan to the other consulting parties for review and comment. The consulting parties shall have 45 days from receipt of the draft Treatment Plan to comment in writing to FTA and TJPA. Failure of the consulting parties to respond within this time frame shall not preclude FTA and TJPA from finalizing the draft Treatment Plan to their satisfaction. Before finalizing the draft Treatment Plan, FTA and TJPA will provide the consulting parties with written documentation indicating whether and how the draft Treatment Plan will be modified. Unless any consulting party

objects to this documentation in writing to FTA and TJPA within 15 days following receipt, FTA and TJPA may finalize the draft Treatment Plan as they deem appropriate, and proceed to implement the final Treatment Plan. If FTA and TJPA propose to modify the final Treatment Plan, TJPA, on behalf of FTA, will notify the consulting parties concurrently in writing about the proposed modifications. The consulting parties will have 15 days from receipt of notification to comment in writing to FTA and TJPA. Failure of the consulting parties to respond within this time frame shall not preclude FTA and TJPA from modifying the final Treatment Plan to their satisfaction. Before modifying the final Treatment Plan, FTA and TJPA will provide the consulting parties with written documentation indicating whether and how the final Treatment Plan will be modified. Unless any consulting party objects to this documentation in writing to FTA and TJPA within 15 days following receipt, FTA and TJPA may modify the final Treatment Plan as they deem appropriate, and proceed to implement the modified final Treatment Plan.

**C. Treatment Plan Reporting Requirements**

1. If pursuant to section B., above, of this stipulation, a Treatment Plan has been implemented, then within two years after FTA, in consultation with TJPA, has determined that all fieldwork required by the Treatment Plan has been completed, FTA will ensure that TJPA prepares a draft technical report that documents the results of implementing the Treatment Plan and distributes this draft technical report to the other MOA signatories for review. The reviewing parties will be afforded 60 days following receipt of the draft technical report to submit any written comments to FTA and TJPA. Failure of the reviewing parties to respond within this time frame shall not preclude FTA from authorizing TJPA to revise to the draft technical report as FTA and TJPA may deem appropriate. FTA will provide the reviewing parties with written documentation indicating whether and how the draft technical report will be modified in accordance with any reviewing party comments. Unless the reviewing parties object to this documentation in writing to FTA and TJPA within 30 days following receipt, FTA and TJPA may modify the draft technical report as they may deem appropriate. Thereafter, FTA and TJPA may issue the technical report in final form and distribute this document in accordance with paragraph C.2 of this stipulation.

2. Copies of the final technical report documenting the results of Treatment Plan implementation will be distributed by TJPA to the other signatory parties, to any consulting Native American Tribe if prehistoric, protohistoric or ethnographic period archaeological properties were located and addressed under the Treatment Plan, and to the appropriate California Historical Resources Information Survey (CHRIS) Regional Information Center, subject to the terms of stipulation IV.E.

3. FTA will ensure that TJPA prepares a written draft document that communicates in lay terms the results of Treatment Plan implementation to members of the interested public. TJPA will distribute this written draft document for review and comment concurrently with and in the same manner as that prescribed for the draft written technical report prescribed by paragraph C.1. of this stipulation. If the draft document prescribed hereunder is a publication such as a report or brochure, then such publication shall upon completion be distributed by TJPA to the other signatory parties, to any consulting Native American Tribe as applicable, and to any other entity that the signatory parties and, as applicable, any consulting Native American Tribe, through consultation may deem appropriate, subject to the terms of Stipulation IV.E.

4. TJPA will prepare a written annual report describing the status of its efforts to comply with the terms of stipulations II. – IV., inclusive, of this MOA. The annual report will be prepared following the end of each fiscal year (July 1 to June 30) that this MOA is in effect

and will be distributed by TJPA to all MOA signatories by July 30 of each year until FTA and the SHPO through consultation determine that the requirements of stipulations II. - IV., inclusive, of this MOA have been satisfactorily completed.

**D. Treatment Plan Not Developed -- Addressing Discoveries**

If the consulting parties agree that a plan for treatment of archaeological properties will not be prepared, then any archaeological properties discovered during implementation of any aspect of the Undertaking will be addressed by TJPA pursuant to 36 CFR § 800.13(b)(3).

**E. Confidentiality**

The signatories to this MOA acknowledge that historic properties covered by this MOA are subject to the provisions of § 304 of the National Historic Preservation Act of 1966, as amended, and § 6254.10 of the California Government Code (Public Records Act), relating to the disclosure of archaeological site information and, having so acknowledged, will ensure that all actions and documentation prescribed by this MOA are consistent with § 304 of the National Historic Preservation Act of 1966, as amended, and § 6254.10 of the California Government Code.

**F. Treatment of Human Remains of Native American Origin**

The parties to this MOA agree that Native American burials and related items discovered during implementation of the terms of the MOA and of the Undertaking will be treated in accordance with the requirements of § 7050.5(b) of the California Health and Safety Code. If, pursuant to § 7050.5(c) of the California Health and Safety Code, the county coroner/medical examiner determines that the human remains are, or may be of Native American origin, then the discovery shall be treated in accordance with the provisions of § 5097.98(a)-(d) of the California Public Resources Code. TJPA will ensure that to the extent permitted by applicable law and regulation, the views of any consulting Native American Tribe and the Most Likely Descendant(s) are taken into consideration when decisions are made about the disposition of other Native American archaeological materials and records.

## V. Resolving Objections

**A.** Should any party to this MOA object at any time to the manner in which the terms of this MOA are implemented, or to any action carried out or proposed with respect to implementation of the MOA (other than the Undertaking itself) or to any documentation prepared in accordance with and subject to the terms of this MOA, FTA shall immediately notify the other parties to this MOA of the objection and consult with the objecting party and the other parties to the MOA for no more than 21 days to resolve the objection. FTA shall reasonably determine when this consultation will commence. If the objection is resolved through such consultation, the action in dispute may proceed in accordance with the terms of that resolution. If, after initiating such consultation, FTA determines that the objection cannot be resolved through consultation, then FTA shall forward all documentation relevant to the objection to the ACHP, including FTA's proposed response to the objection, with the expectation that the ACHP will, within thirty (30) days after receipt of such documentation:

1. Advise FTA that the ACHP concurs in FTA's proposed response to the objection, whereupon FTA will respond to the objection accordingly; or

2. Provide FTA with recommendations, which FTA will take into account in reaching a final decision regarding its response to the objection; or

3. Notify FTA that the objection will be referred for comment pursuant to 36 CFR § 800.7(a)(4), and proceed to refer the objection and comment. FTA shall take the resulting comments into account in accordance with 36 CFR 800.7(c)(4) and Section 110(1) of the National Historic Preservation Act.

**B.** Should the ACHP not exercise one of the foregoing options within 30 days after receipt of all pertinent documentation, FTA may assume the ACHP's concurrence in its proposed response to the objection.

**C.** FTA shall take into account any ACHP recommendation or comment provided in accordance with this stipulation with reference only to the subject of the objection. FTA's responsibility to carry out all other actions under this MOA that are not the subject of the objection will remain unchanged.

**D.** FTA shall provide all other parties to this MOA, any consulting Native American Tribe, and the ACHP when the ACHP has issued comments hereunder, with a copy of its final written decision regarding any objection addressed pursuant to this stipulation.

**E.** FTA may authorize any action subject to objection under this stipulation to proceed after the objection has been resolved in accordance with the terms of this stipulation.

**F.** At any time during implementation of the measures stipulated in this MOA, should an objection pertaining to such implementation be raised by a member of the public, FTA shall notify the parties to the MOA, and any Native American Tribe, in writing of the objection and take the objection into consideration. FTA shall consult with the objecting party and, if the objecting party so requests, with any of the other MOA signatories and any consulting Native American Tribe, for no more than 30 days. Within 10 days following closure of this consultation period, FTA will render a decision regarding the objection and notify all consulting parties of its decision in writing. In reaching its decision, FTA will take into account any comments from the consulting parties regarding the objection, including the objecting party. FTA's decision regarding the resolution of the objection will be final. FTA may authorize any action subject to objection under this paragraph to proceed after the objection has been resolved in accordance with the terms of this paragraph.

**G.** Disputes pertaining to the National Register eligibility of properties covered by this MOA will be addressed by FTA in accordance with 36 CFR § 800.4(c)(2).

## VI. Amendments

Any party to this MOA, or any consulting Native American Tribe, may propose that this MOA be amended, whereupon the parties to this MOA and, as applicable, any consulting Native American Tribe, will consult to consider such amendment. The amendment process shall comply with 36 CFR §§ 800.6(c)(1) and 800.6(c)(7). The time frame for such consultation shall be determined by FTA, in consultation with SHPO and TJPA. This MOA may be amended only upon the written agreement of the signatory parties. If it is not amended, this MOA may be terminated by either signatory party in accordance with Stipulation VII.

## VII. Termination

**A.** If this MOA is not amended as provided for in Stipulation VI., or if either signatory party proposes termination of this MOA for other reasons, the signatory party proposing termination shall in writing, notify the other parties to this MOA and any consulting Native American Tribe,

explain the reasons for proposing termination, and consult with the other parties and any consulting Native American Tribe to seek alternatives to termination. The time frame for such consultation shall be determined by FTA, in consultation with SHPO and TJPA. Such consultation shall not be required if FTA proposes termination because the Undertaking no longer meets the definition set forth in 36 CFR § 800.16(y).

**B.** Should such consultation result in an agreement on an alternative to termination, then the parties and any consulting Native American Tribe shall proceed in accordance with the terms of that agreement.

**C.** Should such consultation fail, the signatory party proposing termination may terminate this MOA by promptly notifying the other parties to this MOA and any consulting Native American Tribe in writing. Termination hereunder shall render this MOA without further force or effect.

**D.** If this MOA is terminated hereunder, and if FTA determines that the Undertaking will nonetheless proceed, then FTA shall proceed in accordance with 36 CFR § 800.6 to develop a new MOA.

## VIII. Duration of the MOA

**A.** Unless terminated pursuant to Stipulation VII., or unless it is superseded by an amended MOA, this MOA will be in effect following execution by SHPO until FTA, in consultation with the other parties and any consulting Native American Tribe, determines that all of its stipulations have been satisfactorily fulfilled. This MOA will terminate and have no further force or effect on the day that FTA notifies the other parties and any consulting Native American Tribe in writing of its determination that all stipulations of this MOA have been satisfactorily fulfilled.

**B.** The terms of this MOA shall be satisfactorily fulfilled within 12 years following the date of execution by SHPO. If FTA determines that this requirement cannot be met, the parties to this MOA and any consulting Native American Tribe will consult to reconsider its terms. Reconsideration may include continuation of the MOA as originally executed, amendment or termination. In the event of termination, FTA will comply with Stipulation VII.D. if it determines that the Undertaking will proceed notwithstanding termination of this MOA.

**C.** If the Undertaking has not been implemented within 12 years following execution of this MOA by the SHPO, this MOA shall automatically terminate and have no further force or effect. In such event, FTA shall notify the other parties and any consulting Native American Tribe in writing and, if it chooses to continue with the Undertaking, shall reinitiate review of the Undertaking in accordance with 36 CFR Part 800.

## IX. EFFECTIVE DATE

This MOA will take effect on the date that it has been executed by SHPO.

Execution of this MOA by FTA and SHPO, its transmittal by FTA to the ACHP in accordance with 36 CFR § 800.6(b)(1)(iv), and subsequent implementation of its terms, shall evidence, pursuant to 36 CFR § 800.6(c), that this MOA is an agreement with the ACHP for purposes of Section 110(1) of the National Historic Preservation Act, and shall further evidence that FTA has afforded the ACHP an opportunity to comment on the Undertaking and its effects on historic properties, and that FTA has taken into account the effects of the Undertaking on historic properties.

**SIGNATORY PARTIES:**

**Federal Transit Administration**

By: _____ Date: 6/21/04
Title: REGIONAL ADMINISTRATOR

**California State Historic Preservation Officer**

By: _____ Date: 6/23/04
Title: Deputy SHPO

**Concurring Signatories:**

**Transbay Joint Powers Authority**

By: _____ Date: 6/4/04
Title: Executive Director

**City and County of San Francisco**

By: _____ Date: 6/4/04
Title: Environmental Review Officer

**Peninsula Corridor Joint Powers Board**

By: _____ Date: 6/3/04
Title: CHIEF DEVELOPMENT OFFICER

**California Department of Transportation**

By: _____ Date: 6/7/04
Title: Deputy District 4 Director

# Appendix A: Protective Measures:

Following are mitigation measures to be implemented to protect properties eligible for on in the National Register of Historic Places. The measures described would be implemented by a combination of construction contract specifications, drawings, and provisions, as well as public affairs programs. TJPA and JPB staff would be assigned to work directly with the public to provide project information and to resolve construction-related problems. The TJPA and JPB will work with community residents, elected officials, local businesses, and community organizations to tailor the mitigation program to best meet community needs. Contractors will be monitored to assure that mitigation measures are met.

## I. Preconstruction Activities

- **Undertake building data survey.** A pre-construction structural survey would be completed to determine the integrity of existing buildings adjacent to and over the proposed extension. This survey would be used to finalize detailed construction techniques along the alignment and as the baseline for monitoring construction impacts during and following construction. During construction, the TJPA and JPB would monitor adjacent buildings for movement and, if movement is detected, take immediate action to control the movement.

- **Complete detailed geotechnical investigation.** During final design, additional sampling (drilling and core samples) and analyses of subsurface soil/rock conditions would be used to detail and finalize the excavation and its support system to be used in the retained cut, cut-and-cover and tunnel portions of the extension. Current data, including subsurface sampling conducted in 1995 and 1996 for the 1997 Caltrain DEIS/DEIR have been used to identify the proposed construction techniques presented in the following sections, which form the basis for the impact analysis that follows in Section 5.21.

## II. General Construction Measures

- **Provide signage.** The TJPA and JPB would work with establishments affected by construction activities. Appropriate signage would be developed and displayed to direct both pedestrian and vehicular traffic to businesses via alternate routes.

- **Install level deck.** Decking at the under-street cut-and-cover sections would be installed flush with the existing street or sidewalk levels.

- **Provide for efficient sidewalk design and maintenance.** Wherever feasible, sidewalks would be maintained at the existing width during construction. Where a sidewalk must be temporarily narrowed during construction (e.g., deck installation), it would be restored to its original width during the majority of construction period. In some places this may require placing the temporary sidewalk actually on the deck. Each sidewalk design should be of good quality and approved by the Resident Engineer prior to construction. Handicapped access would be maintained during construction where feasible.

## III. Soils/Geology

- **Underpin existing buildings, where deemed necessary, to protect existing structures from potential damage that could result from excessive ground movements during construction.** The design of the tunneling and the excavation procedures (and construction sequence), and the design of the temporary support system will be developed with the objective of controlling ground deformations within small enough levels to avoid damage to adjacent structures.

Where the risk of damage to adjacent structures is too great, special measures may be implemented such as: (1) underpinning, (2) ground improvement, and/or (3) strengthening of existing structures to mitigate the risks.

The cut-and-cover alignment passes near settlement-sensitive structures in the vicinity of the intersection of Second and Townsend streets, including buildings in the Rincon Point / South Beach Historic Warehouse – Industrial District (i.e., 166-178, 180, , and 350-360 Townsend Street).

The tunnel alignment passes under a number of old and settlement-sensitive structures in the vicinity of the intersection of Second and Townsend streets, including buildings in the Rincon Point / South Beach Historic Warehouse – Industrial District (i.e., 130, 136, 144-146, 148-154, and 162-164 "Townsend Street; 634, 640, 650, and 670-680 Second Street; and 301-321 Brannan Street).

Even though the tunnel will be excavated using the stacked drift method, and even though the tunnel will be excavated in the Franciscan Rock formation, the risk of potential adverse impacts of tunneling on the existing buildings must be assessed, because the rock cover over the tunnel is rather shallow.

As part of the initial studies performed in 1996, preliminary plans were developed to protect/strengthen existing structures to mitigate the risk of adverse impacts of tunneling on existing structures. Underpinning, if it is deemed necessary, is one of the options for mitigating adverse effects of tunneling on the existing buildings. Underpinning involves modification of the foundations of the building so that the superstructure loads can be transferred beyond the zone of influence of tunneling. Underpinning may include internal strengthening of the superstructure, bracing, reinforcing the existing foundations, or replacing the existing foundations with deep foundations that are embedded outside the zone of influence of tunneling.

Other alternatives, in lieu of underpinning, involve strengthening of the rock between the building and the crown of the tunnel. Grouting in combination with inclined pin piles can be used not only to strengthen the rock but to make the rock mass over the tunnel act as a rigid beam, which would allow construction of the tunnels with no adverse effects on the buildings that are supported on shallow foundations over the tunnel.

Preliminary plans for underpinning have been developed that allow cost estimates to be made for underpinning. During the detailed design phase of the Project, underpinning plans will be developed specific to each of the buildings that may require it. It is not necessary at this stage of the Project to develop detailed underpinning plans.

These issues will be addressed on a case by case basis, along the alignment, during the detailed design phase of the Project. The methodology that is proposed for the Caltrain Downtown Extension, i.e. to design the support system to control ground deformations within tolerances, and selectivity strengthen structures that may be too weak to resist even small deformations, was successfully used for the Muni Metro Turnback project, and should be effective for the Caltrain Downtown Extension Project as well.

- Assure proper design and construction of pile supported foundations for structures to control potential settlement of the surface. Stability of excavations resultant impacts on adjacent structures can be controlled within tolerable limits by proper design and implementation of the excavation shoring systems.

**IV. Air Emissions**

- Upon completion of the construction phase, buildings with visible signs of dirt and debris from the construction site shall be power washed and/or painted (given that permission is obtained from the property owner to gain access to and wash the property with no fee charged by the owner).

**V. Vibration**

- **Limit or prohibit use of construction techniques that create high vibration levels.** At a minimum, processes such as pile driving would be prohibited at distances less than 250 feet from residences.

- **Restrict procedures that contractors can use in vibration sensitive areas.** It is often possible to employ alternative techniques that create lower vibration levels. For example, unrestricted pile driving is one activity that has considerable potential for causing annoying vibration. Using the cast-in-drilled-hole piling method instead will eliminate most potential for vibration impact from the piling.

- Require vibration monitoring during vibration intensive activities.

- Restrict the hours of vibration intensive activities such as pile driving to weekdays during daytime hours.

- Investigate alternative construction methods and practices to reduce the impacts in coordination with the construction contractor if resident annoyance from vibration becomes a problem.

- Include specific limits, practices and monitoring and reporting procedures for the use of controlled detonation. Controlled detonation may be required during tunnel construction through rock for both the cut-and-cover and stacked-drift construction methods, subject to additional geotechnical investigations and other considerations that would be determined during the final design and construction phases of the project. Any use of controlled detonation would be closely controlled and monitored to avoid damage to existing structures. Specific limits, practices, and monitoring and reporting procedures would be included within the contract documents to ensure that such construction methods, if used, would not exceed safety criteria.

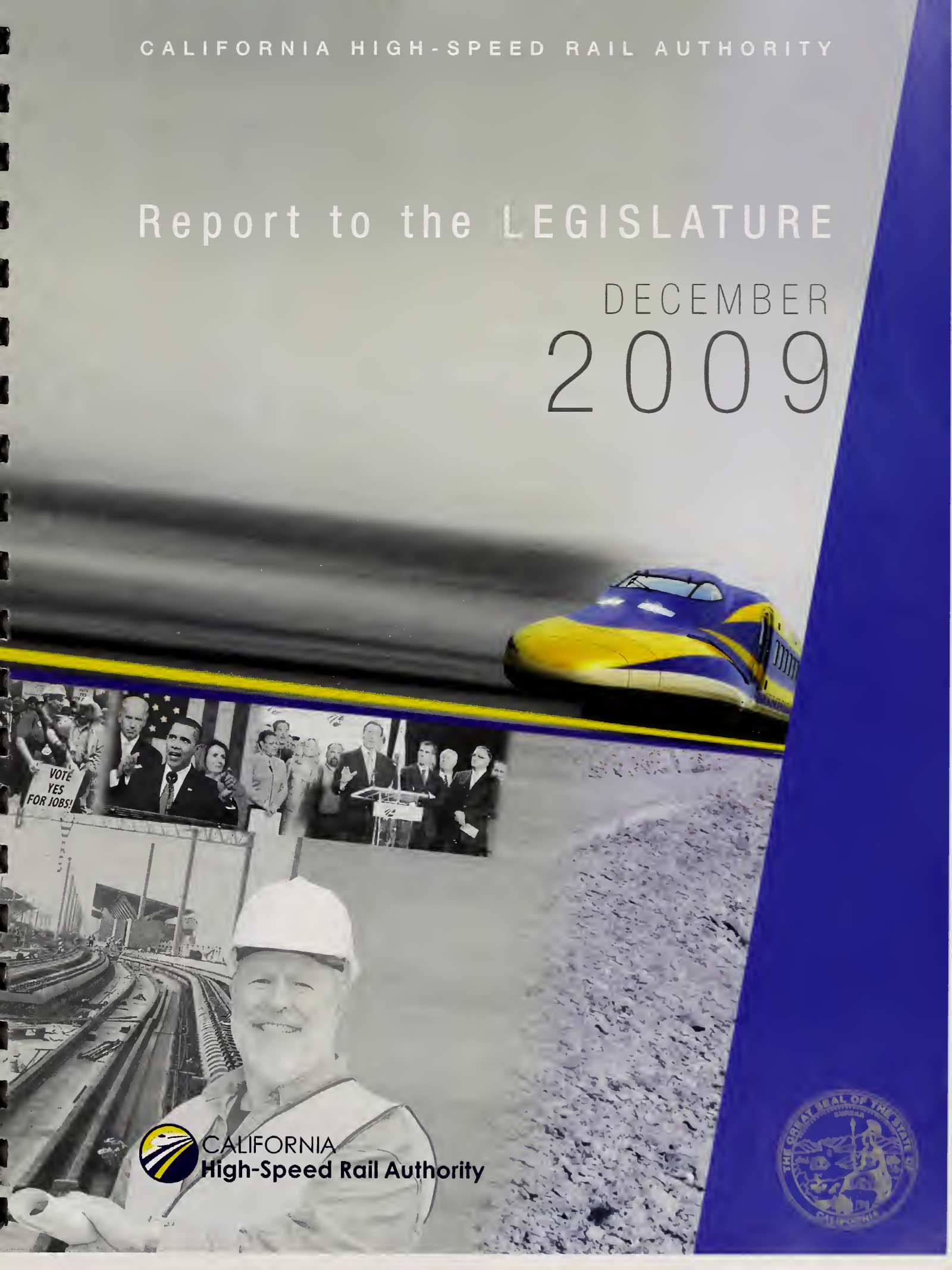
- **Use high-resilience track fasteners or a resiliently supported tie system** for the Caltrain downtown extension for areas projected to exceed vibration criteria.

Exhibit 9a & b

CALIFORNIA HIGH-SPEED RAIL AUTHORITY

# Report to the LEGISLATURE

DECEMBER
2009




CALIFORNIA
High-Speed Rail Authority

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CALIFORNIA
High-Speed Rail Authority

# Introduction / Purpose

The California high-speed train will dramatically change the face of our state – from our economy to our environment, to the communities the system passes through and the way we are viewed around the world. It will create jobs, spur the development of more livable and sustainable communities, help achieve our state's historic greenhouse gas reduction goals, and reinvent Californians' perception of the time and distance across our great state.

Today is an exciting time for high-speed rail development, as interest in the transportation option builds around the globe, and as the President of the United States pursues a vision of transportation in America in which high-speed trains play a leading role.

Over the course of the past year, a number of events have transformed California's high-speed train project from simply an idea into a viable infrastructure project. As such, the California High-speed Rail Authority is also evolving from an entity focused solely on planning a high-speed train project to one that must also build it.

Just over a year ago, the people of California said clearly[1] that they want a high-speed train system – a new transportation option – when they voted in favor of Proposition 1A. And interest in California's project – which has been in planning for some 13 years – has now reached an unprecedented level.

For these reasons, the Legislature rightly included in the 2009-10 State Budget language requiring the California High-Speed Rail Authority to submit a business plan document by Dec. 15, 2009. Subsequent legislation additionally was passed by the Legislature and signed by Governor Schwarzenegger requiring the Authority to submit a revised business plan every two years[2].

This document satisfies the requirement of the Budget Act of 2009[3] and lays out the path forward for California's high-speed rail project.

1 Secretary of State, Statement of Vote, November 2008 General Election, Proposition 1A, the Safe, Reliable High-Speed Train Bond Act
2 Assembly Bill 783 (Ashburn), Chaptered Oct. 11,2009
3 Assembly Bill 4x1, revisions to the Budget Act of 2009, SEC. 148. Item 2665-004-6043 of Section 2.00

# Executive Summary

## On Track to Create Jobs, Stimulate Our Economy, Improve California's Mobility, and Support the President's Vision

Inspired by successes of high-speed train systems around the world, California has for more than 13 years been planning a statewide high-speed rail line that will serve as a backbone and a needed alternative to the state's existing transportation network. Stretching initially from Anaheim/Los Angeles through the Central Valley to San Francisco, and later to Sacramento and San Diego, it will be capable of a 220 mph operating speed and a travel time between Los Angeles and San Francisco of under 2 hours 40 minutes. It will interconnect with other modes of transportation and provide an alternative, more environmentally friendly option to vehicle and air travel.

The California High-Speed Rail Authority is the state entity charged with planning, designing, building, and operating the planned system. To date, the Authority has existed largely as a planning organization, staffed by a small number of state employees, relying largely on contract services, and governed by a nine-member board of directors. However, now the Authority must transform into an implementation entity responsible for what will be the largest public works infrastructure project in state history.

A project of this magnitude will have a significant impact on our economy, in both the short and long terms, and will provide the job creation and stimulus our state needs in this difficult economic time. Construction startup by 2012 is expected to generate 600,000 jobs (one-year, full-time equivalents over approximately 8 years) and kick-start economic activity in design, construction and supply services.

The path from where California's high-speed train project stands today to initial revenue passenger service can be divided into three categories of major milestones: planning, implementation, and revenue service. This document describes the process, shows where the project is currently, and discusses the plan to achieve initial high-speed train service. An ideal timeline shows full, Anaheim/Los Angeles to San Francisco high-speed train service by 2020, with smaller sections opening for limited or shared-use service prior to that time.

Between today and passenger service, it is essential that the Authority conduct effective and thorough outreach to inform Californians about the project and its progress. Effective outreach is integral to achieving the goals of the high-speed train project, and it is incumbent upon the Authority to effectively engage the public in its mission to be transparent and accountable to the people of California. Already, the Authority is putting in place a plan to augment and improve its

outreach efforts, and between today and the commencement of construction, there will be ample and significant opportunities for public input and interaction.

Another stage in the lead up to construction is to refine ridership and revenue estimates. The ridership of a high-speed train system, the revenue it brings in, and its operations costs are all interconnected. Balancing the three elements determines the viability of the system as a business enterprise. This document describes the Authority's current ridership, revenues, and operations costs estimates, and the steps we are taking to further improve those numbers.

This document also updates the projected cost of building the system, describing for the first time the construction costs in terms of the year the dollars will be expended rather than today's current dollars. Previously, the cost of the project had been described in terms of the current year. However, the federal government, through the American Recovery and Reinvestment Act application process, required the description of a project's cost to be made in year-of-expenditure dollars; additionally, to talk about the Proposition 1A bond dollars is to talk in year-of-expenditure terms, as that dollar amount is not indexed to inflation and will remain static, at $9 billion available to the high-speed train project, whether it is expended in 2008, 2018, or even further into the future. This is a more credible manner by which to estimate the cost of the high-speed train project, as California clearly is not constructing the system today but will instead be constructing it over a period of time between 2012 and 2020. The updated cost estimate for the San Francisco-to-Anaheim initial high-speed rail system is $42.6 billion in year-of-expenditure dollars – the bulk of which is due to inflationary costs.

A plan for financing that project cost is included in this document. Bolstered by the unanticipated American Recovery and Reinvestment Act, the state bond dollars approved by California voters, and a new President publicly eager to help build high-speed rail networks in this country, the financial plan lays out a realistic scenario for paying for the system with a combination of state, federal, local, and private funds.

Never before has there been more interest and more momentum behind building a high-speed train system in the United States. Already in California, the Authority has experienced tremendous amounts of interest from private companies who work with train technology as well as construction, in addition to intense interest from foreign governments and consortiums with experience building and operating high-speed train systems overseas. The Authority has executed cooperative information-sharing agreements with a number of countries.

But of course there are risks to a project of this size, scope and nature – risks that could jeopardize the project's completion. Any frank discussion of the project and its planning must include these risks, and any credible plan for the project must address how these risks would be mitigated. This document does that.

Additionally, this document outlines the unprecedented amount of oversight – the comprehensive system of external controls, oversight and review – guiding the Authority's work. The uniqueness and enormity of the project make this scrutiny appropriate and provide greater assurance that the public's interest will be protected and that the project's success will be realized.

In summary, California's high-speed train project is on track and being pushed along by tremendous momentum from our partners in government, the private sector, and the people of our state who know that its construction will mean jobs and economic stimulus and its completion will mean a more mobile, vibrant, environmentally friendly, and interconnected California.

# The Project and Its History

Inspired by successes of high-speed train systems around the world, California has for more than 13 years been planning a statewide high-speed rail line that will serve as a backbone and a needed alternative to the state's existing transportation network. It is envisioned as a new system stretching initially from Anaheim/Los Angeles through the Central Valley to San Francisco, and later to Sacramento and San Diego. It will be capable of 220 mph operating speed and a travel time between Los Angeles and San Francisco of under 2 hours 40 minutes. It will interconnect with other modes of transportation and provide an alternative, environmentally friendly option to vehicle and air travel. Today, the system is more than a vision; it is a reality California is working toward with the support of the state's voters, labor, environmental, and business advocates, and the strong support of the governor and the President of the United States.

## The Project

California's high-speed rail project is a planned transportation backbone whose initial 500 miles will begin in Anaheim/Los Angeles, run through the Central Valley from Bakersfield to Merced, then head northwest into the Bay Area. It will travel up to 220 miles per hour and be able to make its journey from Los Angeles to San Francisco in under 2 hours and 40 minutes. Subsequent phases of the high-speed rail system are planned for a southern extension from Los Angeles to San Diego via the Inland Empire and an extension from Merced north to Sacramento.

The project's goal is to increase and maintain California's mobility, which is vital to our economy's health, as our population grows by a third – from 38 million today to a projected 50 million by 2035.

The project will employ train technologies like those used in other countries with established high-speed train systems (for example: Japan, France, Germany, Great Britain, Spain, Korea and China). That means steel-wheel-on-steel-rail technology, entirely electric power, state-of-the-art safety and signaling systems, and automated train control. This is not new technology – only new to North America. It was introduced in Japan in 1964, France in 1981, and in many other countries within the past two decades.

## PHASE 1 OF PLANNED HIGH-SPEED RAIL SYSTEM

*(Note: These two maps represent the work that has been conducted in the time between the submission of the 2008 Business Plan to the Legislature and Dec. 1, 2009. Subsequent to that date, the High-Speed Rail Authority took action that affects the Bay Area to Central Valley portion of the planned system and the related Program-Level EIR[4]. Also note that the dots on these maps represent station locations and optional station locations; the total number of stations on the system will not exceed 24, per Proposition 1A.)*

## PLANNED SUBSEQUENT HIGH-SPEED RAIL SECTIONS

The system will interface with and complement other modes of transportation – commercial airports, mass transit, the state's highway network, as well as bike paths and foot traffic. The system will be capable of many patterns of service and will compete – as it has in other countries – with air and automobile travel over medium distances.

The California high-speed train will operate primarily on exclusive track with portions of the route shared with other existing passenger rail operations. The route will be constructed at-grade, in an open trench, in a tunnel, or on an elevated guideway, depending on the terrain.

[4] See "Town of Atherton Lawsuit & the High-Speed Rail Line" in the following section within this chapter.

physical constraints, environmental impacts and community input along sections of the line. Extensive portions of the system will lie within, or adjacent to, existing rail or highway right-of-way (rather than new alignment) to reduce potential environmental impacts and minimize land acquisition.

It is a project supported by California's voters, its congressional delegation, environmental advocates, labor and business groups, and the President of the United States, as well as transportation planners, who know that high-speed train technology has proven to be the safest and most reliable form of transportation.

## History

Inspired by the successes of high-speed train systems in Asia and Europe, the state of California has for decades pondered the possibility of a high-speed passenger rail system in the Golden State.

It first pursued the idea of a Southern California high-speed corridor working with Japanese partners in 1981, under Governor Jerry Brown. Lynn Schenk[5], who was at that time the Secretary of the state Business, Transportation and Housing Agency, went on to represent California in the U.S. Congress, where she wrote the bill creating the first five high-speed rail planning corridors in the country, including California's, and introduced the "High-Speed Rail Development Act of 1994," which was signed into law that year by President Clinton.

In the mid-1990s, as it became clear that California's increasing population was putting a strain on its highways, airports, and conventional passenger rail lines, investigation of the potential for a high-speed rail system began in earnest. Legislative Joint Resolution by then-Senator Quentin Kopp was adopted in 1993 and created the Intercity High-Speed Rail Commission, charged with the task of determining the feasibility of an intercity high-speed rail system in California. Working through the Business, Transportation and Housing Agency, the commission in September 1996 issued its "High-Speed Rail Summary Report and Action Plan," which concluded that such a project was indeed feasible.

Subsequently, that same year, the California High-Speed Rail Authority was created by the Legislature and Governor Pete Wilson. The Authority was tasked with preparing a plan and design for the construction of an economically viable high-speed train line linking major metropolitan areas that would help sustain the state's long-term mobility and economic growth.

Following release of the Authority's first business plan in 2000, the Legislature passed and Governor Gray Davis signed SB 1856 by then-state Senator Jim Costa in 2002 authorizing a $9.95 billion bond issue to finance a new high-speed train system in California. Submission of the measure to the state's voters was delayed several years by the Legislature as part of the state's budget process.

In 2004, the Authority together with its federal partner, the Federal Railroad Administration (FRA), issued a Draft Program-Level Environmental Impact Report/Environmental Impact Statement (EIR/EIS) (two volumes and 64 technical reports) that sought to describe the proposed system and describe its environmental impacts on a statewide scale. Through the public environmental review process, the Authority received and reviewed over 2,000 public and government agency comments on the draft document, which was used to determine preferred corridors and stations for the majority of the proposed line. The program-level EIR/EIS was certified in 2005. An additional program-level EIR/EIS was certified in 2008 that examined the path between the Central Valley and the Bay Area.

[5] See Schenk biography in following section, "The High-Speed Rail Authority."

## Town of Atherton Lawsuit & the High-Speed Rail Line

**In August 2008**, a group of petitioners filed a lawsuit in Sacramento County Superior Court claiming the Authority's Final Bay Area to Central Valley Program EIR violated the California Environmental Quality Act (CEQA) in numerous ways. (Town of Atherton, et al., v. California High-Speed Rail Authority, et al., Sacramento Superior Court Case No. 34-2008-80000022.) The Program EIR examined network alternatives for connecting the High-Speed Train system between the San Francisco Bay area and the Central Valley, particularly network alternatives involving the Altamont Pass and the Pacheco Pass.

**In August 2009**, the court issued a ruling upholding the Authority's program EIR in most respects. The court did, however, indicate the program EIR required revision and recirculation in the following areas to comply with CEQA:

- description of the alignment of HST tracks between San Jose and Gilroy;
- impacts to surrounding businesses and residences, the Monterey Highway, and Union Pacific freight operations between San Jose and Gilroy; and
- land-use impacts associated with Union Pacific's denial of the use of its right-of-way.

The court also found that the Authority's CEQA finding on vibration impacts was not supported by substantial evidence. A final judgment was entered on November 3, 2009, and a peremptory writ of mandate issued.

**On December 3, 2009**, the Authority approved resolution #HSRA 10-014[6] , as the first step in complying with the court judgment. This action rescinds the Authority's 2008 certification of the program EIR and related approvals. The Authority directed staff to prepare the necessary revisions to the program EIR and circulate them in accordance with CEQA for public comment. The Authority will consider the revised program EIR and the entire record of material before making a new decision to certify the revised final program EIR. The Authority will also make a new decision on a network alternative, preferred alignments, and preferred station locations for further study in project EIRs.

The Authority has begun the more specific, project-level environmental reviews for individual sections of the system in order to better manage the environmental review process. That is the stage the Authority is currently engaged in as of the submission of this Business Plan, along with the additional work on the Bay Area to Central Valley Program EIR to address issues cited by the court and discussed elsewhere in this report[7].

In 2008, the state Legislature approved and Governor Arnold Schwarzenegger signed Assembly Bill 3034 (Galgiani), which revised Senator Costa's SB 1856 of 2002, finally putting the $9.95 billion bond measure on the November 2008 ballot – $9 billion of which was targeted as partial financing of a high-speed rail system. Proposition 1A, as it was named on the ballot, was approved with 52.7 percent[8] of the vote. It became the country's first-ever voter-approved multibillion-dollar financing mechanism for high-speed rail.

Then, in 2009, newly elected U.S. President Barack Obama included $8 billion in funding within the American Recovery and Reinvestment Act (ARRA) to be directed to high-speed train projects throughout the country. Along with that inclusion, he set out a Vision of High-Speed Rail in America[9] that envisions a comprehensive high-speed intercity passenger rail network through a long-term commitment at both the federal and state levels.

6 http://www.cahighspeedrail.ca.gov/images/chsr/20091201141348_Agenda_Item_3_-_Resolution_HSRA10-012.pdf
7 On December 3, 2009, in order to comply with a Superior Court ruling, the California High Speed Rail Authority Board voted to rescind and the re[illegible] the 2008 EIR, and the Authority is pursuing additional studies prior to bringing the document back before the Board for consideration of [illegible]
8 California Secretary of State's Office, Statement of Vote, 2008 General Election, http://www.sos.ca.gov/elections/sov/2008_general/[illegible]
9 Obama Administration, U.S. Department of Transportation, Federal Railroad Administration, Vision of High Speed Rail in America

As of the submission of this Business Plan, California stands to receive billions of dollars from the ARRA for the construction of high-speed rail. It has requested, through the Governor, nearly $6 billion from that $8 billion pot, $4.7 billion of which was requested specifically for the high-speed train project.

Guidance issued for ARRA funding, which may be announced as early as January 2010, sets a deadline of September 2012 to obligate the federal monies – meaning go to construction.

## Project Expenditure History

Over the course of its 13-year history, the Authority's budget has varied and has come from a variety of funds, including those from regional partner transportation agencies. Below is a chart showing the Authority's funding since its inception, the sources of those funds, and the activities on which they were expended

| FY | Administrative Expenses | 2000 Business Plan | EIR/EIS | Imp. Plan | Outreach | BA/CV EIR/EIS | PE/EIR/EIS | Total | Source |
|---|---|---|---|---|---|---|---|---|---|
| 1997/98 | 380,000 | 1,120,000 | | | | | | 1,500,000 | PTA |
| 1998/99 | 854,000 | 2,146,000 | | | | | | 3,000,000 | PTA |
| 1999/00 | 901,000 | 2,131,000 | | | | | | 3,032,000 | PTA |
| 2000/01 | 926,000 | 100,000 | 5,000,000 | | | | | 6,026,000 | TCRP |
| 2001/02 | 1,021,000 | | | | | | | 1,021,000 | PTA |
| 2001/02 | | | 519,000 | | | | | 519,000 | Prop 116 |
| 2001/02 | | | 2,498,000 | | | | | 2,498,000 | CT/Reimb |
| 2002/03 | 770,000 | | | | | | | 770,000 | PTA |
| 2002/03 | | | 5,750,000 | | | | | 5,750,000 | SHA |
| 2002/03 | | | 1,250,000 | | | | | 1,250,000 | FTA |
| 2002/03 | | | 158,000 | | | | | 158,000 | CT/Reimb |
| 2003/04 | 750,000 | | 852,000 | 758,000 | 200,000 | | | 2,560,000 | PTA |
| 2003/04 | | | 800,000 | 242,000 | 200,000 | | | 1,242,000 | FTA |
| 2004/05 | 636,000 | | 400,000 | | 115,000 | | | 1,151,000 | PTA |
| 2005/06 | 1,176,000 | | 500,000 | 500,000 | 50,000 | 1,420,000 | | 3,646,000 | PTA |
| 2006/07 | 1,113,000 | | | | | 185,000 | 13,255,000 | 14,553,000 | PTA |
| 2007/08 | 1,476,000 | | | | | 218,000 | | 1,694,000 | PTA |
| 2007/08 | | | | | | | 3,500,000 | 3,500,000 | OCTA/Reimb |
| 2007/08 | | | | | | 754,000 | 14,746,000 | 15,500,000 | Prop 116 |
| 2008/09 | 1,748,000 | | | | | | 3,900,000 | 5,648,000 | PTA |
| 2008/09 | | | | | | | 3,500,000 | 3,500,000 | OCTA/Reimb |
| 2008/09 | | | | | | | 5,983,000 | 5,983,000 | Prop 116 |
| 2008/09 | | | | | | | 29,100,000 | 29,100,000 | Prop 1A |
| 2009/10 | 2,225,000 | | | | | | 136,955,000 | 139,180,000 | Prop 1A |
| **Total** | **13,976,000** | **5,497,000** | **17,727,000** | **1,500,000** | **565,000** | **2,577,000** | **210,939,000** | **252,781,000** | |

10 Budgeted

# The High-Speed Rail Authority

## The High-Speed Rail Authority Organization

Established in 1996 by state legislation, the California High-Speed Rail Authority (Authority) is the state entity responsible for planning, constructing, and operating a high-speed train system serving California's major metropolitan areas.

Per state law setting up the Authority, it is governed by a nine-member policy board. The Board members are appointed by the governor and the Legislature – five members appointed by the governor, two by the state Senate, and two by the state Assembly.

To date, the California High-Speed Rail Authority has been a planning organization, staffed by a small number of state employees, relying largely on contract services, and governed by a nine-member board of directors. However, now the Authority must transform into an implementation entity responsible for what will be the largest public works infrastructure project in state history. This section describes the current organization and the steps necessary to grow it into a state entity overseeing construction of the state's high-speed train system.

## Board Members

**Chairperson: Curt Pringle**

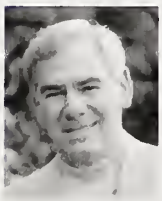
Anaheim Mayor Curt Pringle was appointed to the High-Speed Rail Authority in 2007 by Governor Schwarzenegger and his term expires Dec. 31, 2010. He currently serves as Mayor of the City of Anaheim and president of Curt Pringle & Associates. Pringle has also served as an adjunct faculty member in the political science department at the University of California, Irvine since 2000, where he teaches California government. Previously, he served in the California State Assembly from 1988 to 1990 and 1992 to 1998. While in the Assembly, Pringle served as Speaker in 1996. His term on the High-Speed Rail Authority Board expires December 31, 2010.

**Vice Chairperson: Tom Umberg**

Thomas J. Umberg is an attorney with Manatt, Phelps & Phillips, LLP. In 1995 Umberg was an Assistant U.S. Attorney in Los Angeles and Orange County. In 1997 Umberg was nominated by the President and unanimously confirmed by the United States Senate as Deputy Director of the White House Office of National Drug Control Policy (ONDCP). Umberg served three terms in the California Legislature, most recently between 2004 and 2006. He serves as a colonel in the U.S. Army Reserve, and is currently on active duty in Afghanistan, where he participates in monthly Authority Board meetings by telephone. His term on the High-Speed Rail Authority Board expires December 31, 2011.

Board Members:

**David Crane**, of San Francisco, has served on the Board of the High- Speed Rail Authority since 2007, having been appointed by Governor Schwarzenegger. He currently serves as special advisor to the governor for jobs and economic growth. Before joining the Administration, Crane was a partner with Babcock & Brown, a financial services firm. His term on the High-Speed Rail Authority Board expires December 31, 2012.



**Rod Diridon, Sr.**, of Santa Clara is a Governor's Office appointee to the Board. He has served on the Authority since 2001, serving two terms as chair. Additionally, Diridon serves as the executive director of the Mineta Transportation Institute. Previously, he served on the Santa Clara County Board of Supervisors from 1975 to 1995 and served as chair of the Board for six terms. Diridon is past chair of the Metropolitan Transportation Commission, American Public Transit Association, Bay Area Air Quality Management District and the Association of Bay Area Governments. He is the president and founder of the California Trolley and Railroad Corporation. His term on the High-Speed Rail Authority Board expires December 31, 2009.

**Richard Katz,** of Sherman Oaks, is the owner of a public policy and government relations firm based in Los Angeles, Richard Katz Consulting, Inc. Katz was California's lead negotiator for the landmark Colorado River Agreement between the State of California, the Federal Government, four California Water Agencies, and the six Colorado River Basin States. Shortly after his election in June of 2005, Los Angeles Mayor Antonio Villaraigosa appointed Katz to serve with him on the Governing Board of the Metropolitan Transportation Authority. In September 2008, following the tragic Metrolink crash, Mayor Villaraigosa appointed him to the Metrolink board in order to lead the effort to right the agency. Governor Davis appointed Katz as his Senior Advisor on Energy and Water issues in 2001. Also in 2001, Katz was appointed to the State Water Resources Control Board. Confirmed by the Senate, he served for five years, occupying the water quality seat on the State Board. Katz was first elected to the California State Assembly in 1980, serving continuously for 16 years, 10 of which were as Chair of the Assembly Transportation Committee. Katz' term on the High-Speed Rail Authority Board expires December 31, 2011.

**Lynn Schenk** is an attorney and senior corporate advisor who served as Chief of Staff to California Governor Gray Davis from 1999 to 2003. In 1992 she became the first woman elected to the United States House of Representatives to represent the San Diego area. From 1978 to 1983, Ms. Schenk served in the Cabinet of Governor Jerry Brown as California's Secretary of Business, Transportation and Housing (the first woman to hold this Cabinet post). Prior to her state Cabinet appointment, Ms. Schenk served as a Deputy Attorney General in the criminal division of the California Attorney General's office, followed by several years as an in-house lawyer to the San Diego Gas & Electric Company. In 1976, she was appointed a White House Fellow by President Ford serving as a special assistant to Vice-Presidents Nelson Rockefeller and Walter Mondale. A gubernatorial appointee to the High-Speed Rail Authority Board, her term expired in December 2004.

**Fran Florez** is a former City Council member and Mayor of the city of Shafter. Florez, who retired from the banking industry after 35 years, is one of the principals of Florez & Florez consulting firm and has contracted her services exclusively to Pacific Gas and Electric Company's Public Affairs Department. She served as Board chairperson from September 2005 until September 2006. Her term on the High-Speed Rail Authority Board expires December 31, 2012.

**The Honorable Judge Quentin L. Kopp** was appointed to the San Mateo Superior Court on January 1, 1999, by Governor Pete Wilson. Judge Kopp retired effective January 31, 2004, but was immediately accepted in the Assigned Judges Program of the California Judicial Council. On June 13, 2006, the state Senate appointed him to the California High-Speed Rail Authority. He served in the California State Senate from December 1, 1986, until December 7, 1998, and as a member of the City and County of San Francisco Board of Supervisors to which he was first elected in November 1971, and re-elected four times thereafter. Judge Kopp served as an ex-officio member of the California Transportation Commission from 1988 until 1998, as a member of the California Law Revision Commission from 1995 until 1998, and a member of the Little Hoover Commission from 1996 until 1998. As an elected local and state legislator for 27 years, Judge Kopp also served as a leader on virtually every regional governmental policy-making body affecting the Bay Area. His term on the High-Speed Rail Authority Board expires December 31, 2010.

**Russ Burns** is business manager of Operating Engineers Local 3, and was appointed to the Authority board by Assembly Speaker Karen Bass. He previously served on the Cal-OSHA Standards Board Subcommittee for Certification of Crane Operators. A third-generation operating engineer and Local 3 member, Burns started his career as a crane operator on a variety of high rises, bridges, refineries and large treatment plants throughout Northern California and Reno, NV. He joined the Local 3 staff in 1994. Burns was recently re-appointed to the Authority and his term expires December 31, 2013.

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The Authority is staffed by a small number of state employees charged with oversight of the effort to build the high-speed train system in California. It currently has state budget authority for 11.5 personnel-year-equivalents (PYs).

However, due largely to major events over the past 13 months, it is now required that the Authority's organization change and grow.

- Additional state staff is needed to oversee and administer the federal and state bond dollars that are soon to be in hand, and additional staff is needed to increase public outreach and ensure adequate risk management over increasing amounts of work being conducted by contractors. A plan is already in place to augment the Authority's staff, and is laid out below.
- The Authority Board has a need to become more engaged in the project's details and progress. That transition is already taking place under newly elected Chairman Pringle.

- The contract Program Management Team must prepare to transition from a planning and environmental review phase to a construction phase. A plan for such a transition is laid out below.

Adjusting the Authority's organization to properly suit the project ahead of it will require the partnership and cooperation of several entities, including the Department of Finance, the Legislature, and the Governor's Office.

The Authority's staff organization currently consists of an Executive Director (Mehdi Morshed[11]), three Deputy Directors (Finance and Administration, Environmental and Planning, and Communications, Public Policy and Outreach), a small support staff, as well as a Chief Engineer contractor, a Project Management Oversight Management contractor, Government Relations Management contractor, a Program Management Team, and Regional Project Management Teams. Additionally, the Authority employs a financial consultant contractor and a public outreach and communications contractor. The California Attorney General's office provides legal support to the Authority on all matters including review of the environmental deliverables up to and including the Final Environmental Report (EIR) and the Notice of Determination (NOD). The current overall project organization is illustrated on the following chart.

The California high-speed train system is also sponsored by the Federal Railroad Administration (FRA). The FRA is the federal lead agency under the National Environmental Policy Act (NEPA) responsible for technical and legal review of the regional project Environmental Impact Statements (EISs). All environmental deliverables up to and including the Final EIS and Record of Decision (ROD) will be subject to FRA approval. Likewise, the Authority is the state lead agency responsible for preparation and certification of the regional project Environmental Impact Reports (EIRs) required under the California Environmental Quality Act (CEQA).

11 Morshed was the first person appointed to the High-Speed Rail Authority when it was created in 1996.
His biography can be read here: http://www.cahighspeedrail.ca.gov/about/mehdi-morshed.htm

Over the past 10 years the Authority's limited staff members have managed to oversee all the activities related to the planning and environmental work for a state high-speed train. During those years the Authority's budget has varied from $1.5 million to nearly $140 million annually, while the number of full-time-equivalent state positions (PYs) has grown only from 5 to 11.5 (see chart to right).

| FY | Total Budget | PYs | Notes |
|---|---|---|---|
| 1997/98 | 1,500,000 | 3 | |
| 1998/99 | 3,000,000 | 4.5 | |
| 1999/00 | 3,032,000 | 5 | |
| 2000/01 | 6,026,000 | 4.5 | |
| 2001/02 | 4,038,000 | 4 | |
| 2002/03 | 7,928,000 | 4 | |
| 2003/04 | 3,802,000 | 4 | |
| 2004/05 | 1,151,000 | 3.5 | |
| 2005/06 | 3,646,000 | 3.5 | |
| 2006/07 | 14,553,000 | 6.5 | |
| 2007/08 | 20,694,000 | 6.5 | |
| 2008/09 | 44,231,000 | 9.5 | |
| 2009/10 | 139,180,000 | 11.5 | 8.5PYs currently filled |
| **Total** | **252,781,000** | | |

With the passage of the $9.95 billion bond measure last November, the mission and the objective of the Authority, its staff, and its contractors changed significantly. The promise of federal American Recovery and Reinvestment Act (ARRA) funds additionally has changed the Authority's mandate. Put simply, the Authority is now building a high-speed train system, not just building the hopes of one. Instead of the gradual and intermittent planning and environmental studies to match limited funds, the Authority must now proceed toward construction and operation and do it as quickly as possible.

That means the Authority staff must be augmented to properly direct and oversee the work of its contractors moving forward in a manner that will preserve the intent of the project and protect public funds.

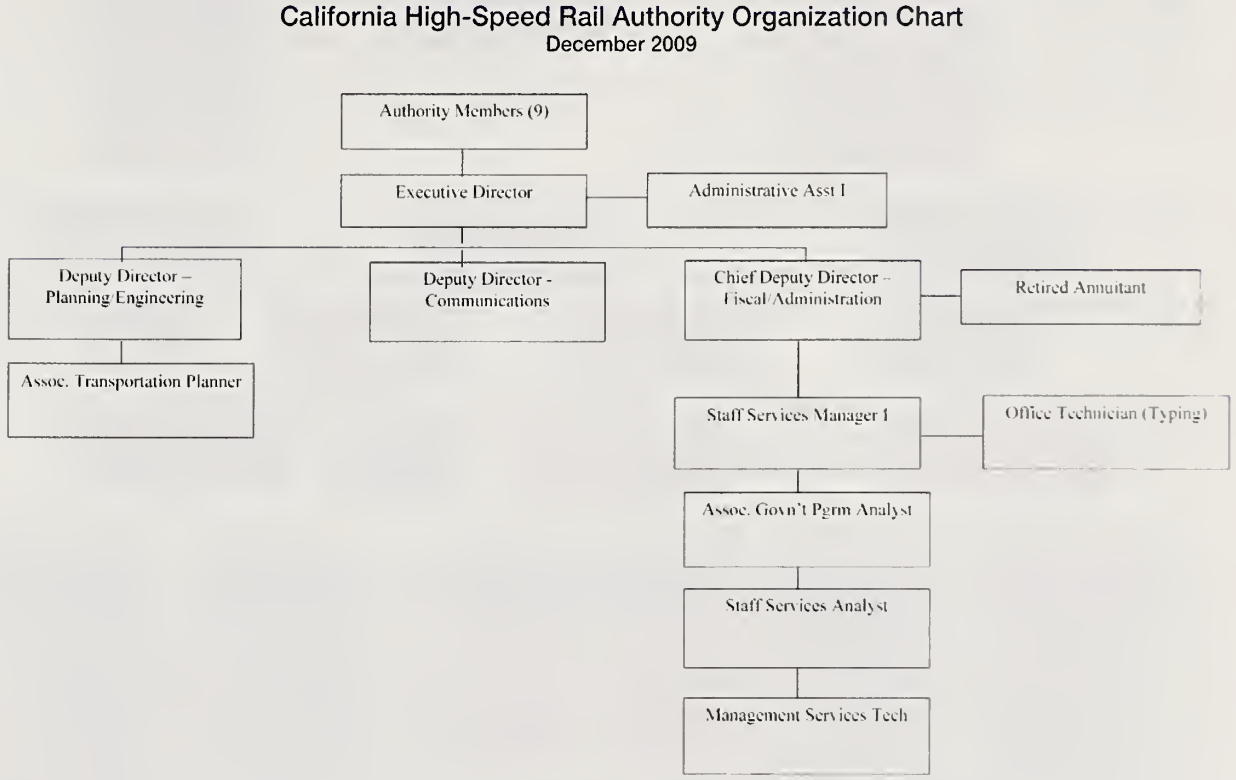
To systematically determine the personnel demand for the future activities, the Authority entered into a contract with the firm of KPMG to evaluate the current activities, the future needs, and the kind of organization and personnel that are necessary to carry out the required work. The KPMG report[12] is a good guideline on the kind of organizational structure that is necessary to implement the mission and objectives of the Legislature and the governor who placed the proposal before the voters, the voters who approved it, and the Authority. The recommendations of that report – currently being acted on by the Authority – are discussed in the following section.



12 Available at the High-Speed Rail Authority's Web site, at this URL: http://www.cahighspeedrail.ca.gov/images/chsr/20091103104811_11-05-09_Agenda_Item_11_attachment_to_Committee_Mtg_Item_2.pdf

## Today's Organization

CURRENT STATE EMPLOYEE STAFF



Because of the lack of budget authority to hire additional staff, many key functions are currently being performed by contractors. Those functions include: oversight of the Program Management Team (contractor T.Y. Linn being brought on in December 2009); legal services (provided by the state Attorney General's Office and Nossaman LLC lawfirm); fiscal services (through the Department of General Services); personnel services (through Caltrans); legislative affairs (contractor); chief engineer (contractor); IT services (provided by contractor Paperless Knowledge); and regional director roles (two regional directors provided through joint agreements with Caltrans in the Central Valley and Caltrain in the Bay Area).

## Moving Forward

As the California high-speed train project moves toward construction, the Authority's state staff must be augmented in order to ensure governance and decision-making in the public interest, as well as accountability and transparency.

The study conducted by KPMG and the resulting report provide a basis for necessary adjustments to the Authority's staff. With the input and approval of the Authority's Board, the Authority will immediately begin working to augment its staff.

The report pointed to the need to either create or bring in-house several key positions:

- **A "Chief Executive Officer" to lead the Authority in achieving its new mission**

  – Establishing a Chief Executive Officer position at the helm of the Authority will convey to the public, policy-makers, industry, and the markets that the Authority "means business" as it embraces this new phase

  – The CEO title is more widely used in certain local government and non-profit organizations, especially those that operate utilities or other "enterprises" that must attract and retain users in order to generate revenues, much like private businesses

- **An experienced, in-house "Chief Program Manager"**

  – The position is more than a "Chief Engineer" – encompassing responsibility for the Project life cycle, from planning and environmental, design and construction, to implementation and operation

- **An experienced, in-house "Chief Financial Officer"**

  – The Authority needs a highly-credible financial specialist for driving funding strategies and communicating with policy makers and the markets

- **A dedicated office for "Project Controls and Risk Management" (including quality assurance and health and safety)**

  – Importance of these functions warrants a direct line to the Chief Executive Officer

- **"General Counsel"**
- **"Regional Directors"**

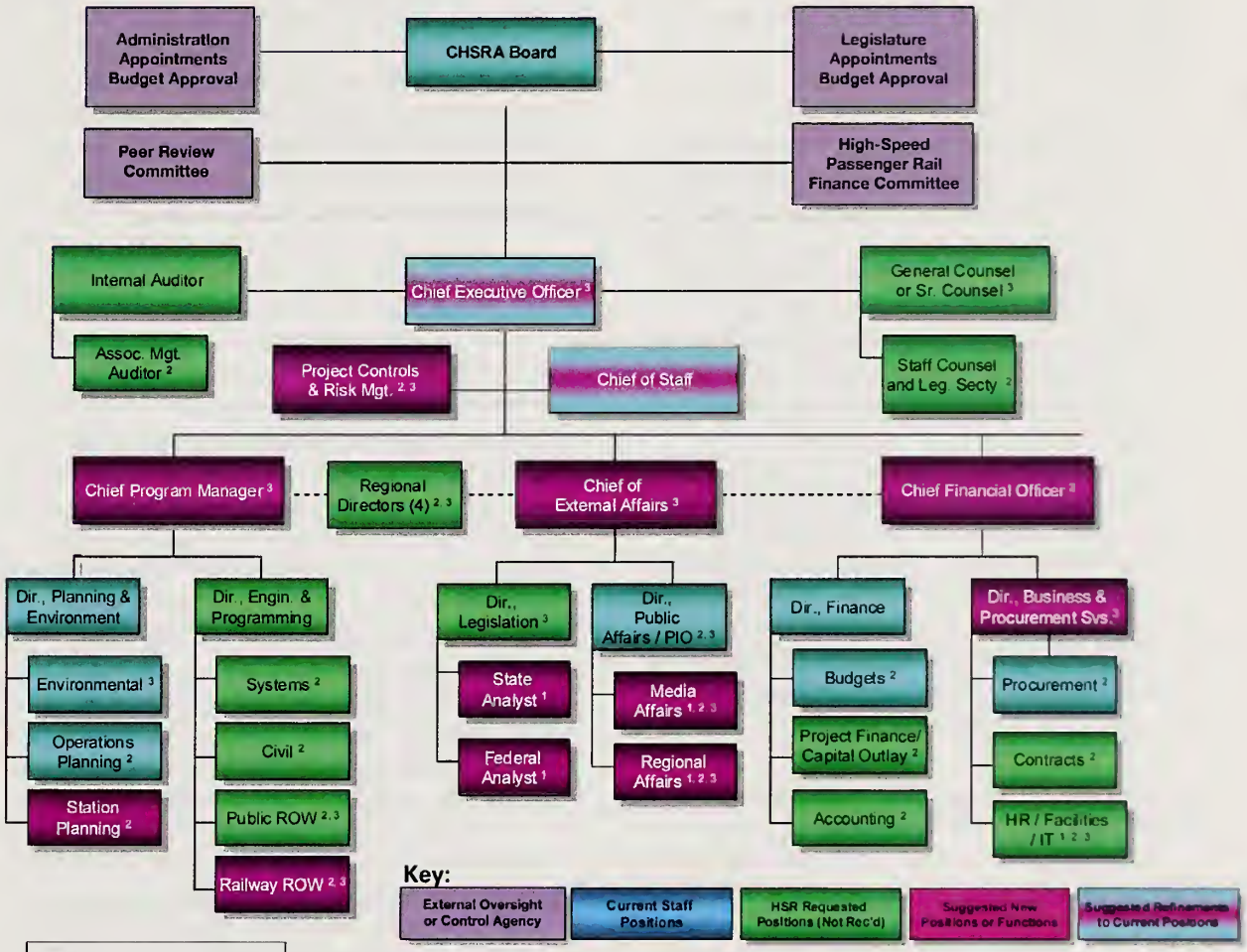
  – There is a need for additional regional directors, and the existing regional directors ought to be brought in-house

- **"Internal Auditor"**

Additional senior positions also are needed to perform mission critical functions, including both existing and new positions:

- **Director, Legislation**
- **Director, Engineering and Programming**
- **Director, Business and Procurement Services**

## PROPOSED FUTURE STATE STAFF ORGANIZATION




**Notes:**

1) State employees or contractors.

2) Chart does not include administrative/office tech positions, so additional positions would be required to serve these functions, commensurate with workload. Overall "headcount" would vary in functions below the Director level, primarily small in the near-term, and growing only as workload required

3) Also interfaces frequently to oversee / coordinate with other contracting state agencies and private consultants, in some cases.

## Next Steps

In order to begin implementing these staffing changes, the Authority needs to initiate a number of important and time-sensitive actions, including:

- Secure support from the Administration, Legislature, and key stakeholders for the Authority's desired staffing, organizational structure, and timing. This should include the necessary legislative and executive actions to provide the Authority with additional exempt entitlements to facilitate the hiring of quality individuals from either inside or outside of state service at competitive salaries.
- Carefully manage the recruitment effort to attract world-class talent. This may include engaging a qualified search firm(s) or human resources consultant(s) to refine position parameters, identify appropriate classifications, and assess the competitive landscape, before establishing positions or commencing recruitment.

## A Focus on Contracting

### Rationale

It is a policy of the Authority's Board that the Authority rely on a relatively small core staff of state employees and employ contractors for the bulk of the project work. This policy marries well with a project of this nature, which requires highly specialized personnel for only short periods of time. For example, the project is currently in the environmental review phase, and therefore needs engineers and planners knowledgeable about state and federal environmental review processes. However, this phase of the project will be complete within the next couple of years, and those personnel and specific skills will no longer be needed by the Authority. So, it makes more fiscal sense to employ these personnel as contractors rather than establishing state employee positions that are finite in nature.

Using contractors also allows the Authority to quickly augment or reduce its staff as necessary. The alternative would be a rigid and slow state hiring process.

Recently, a reliance on contractors has assisted the Authority in maintaining its work schedule, as contract personnel are not subject to the governor-ordered three-days-per-month furloughs.

### Contracts

The following is a summary of the scope of work, overall budget, and terms of all of the Authority's major contracts. All of the contractors, with the exception of the legal services contract, prepare and deliver an annual work program which is due to the Authority staff in early Spring. The annual work programs include a scope of work, list of deliverables, schedule, and budget which Authority staff review, comment and negotiate prior to the start of the fiscal year. Each contractor is provided a notice to proceed based on the negotiated annual work program immediately after the enactment of the state budget.

### Program Management Contract

Contractor Name:
Parsons Brinckerhoff Quade & Douglas

Agreement Total: $199,000,000.00

Term: 11/20/2006 – 06/30/2013

The Program Management Team (led by Parsons Brinckerhoff) is providing day-to-day management of the program, working closely with the Authority staff and directing the work of other consultants. The work of Parsons Brinckerhoff (PB) includes development of project controls, design and engineering criteria, system specifications, environmental methodologies, working with the Federal Railroad Administration on compliance issues, as well as working with state and federal resource agencies in order to successfully obtain environmental clearances and permits. PB is

responsible for the development of a project implementation strategy and master plan, the launch and management of the project level environment work through a series of regional consultants, development of a right-of-way assessment and acquisition program, and the management of procurement, final design and construction, testing and commissioning, and revenue start-up activities. PB will establish the systems necessary to maintain control of the schedule, budget, documentation, procurement, construction contracting strategies, etc. so that project delivery tracks the established schedule and financial targets.

The work of the Program Management Team is discussed in more detail in a section later in this document.

## Regional Contracts

Each regional contractor is responsible for developing engineering (15 percent - 30 percent), planning, and environmental data; for preparing one or more project site specific Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the high-speed train system in their respective corridors; and for providing the described right-of-way preservation and acquisition services in this corridor; as requested by the Authority. The project EIR/EIS will include engineering and environmental impact analysis of the high-speed train line and facilities, including station development, and connections with other modes of transportation. EIR/EIS process(es) will include the involvement of the public, interested groups, and appropriate local, state, and federal agencies, as determined in consultation with Authority staff.

**Region: San Francisco to San Jose**
Contractor Name: HNTB Corporation
Agreement Total: $55,000,000.00
Term: 10/16/2008 – 06/30/2014

**Region: San Jose to Merced**
Contractor Name: Parsons
Agreement Total: $55,000,000.00
Term: 11/12/2008 – 06/30/2014

**Region: Sacramento to Fresno**
Contractor Name: AECOM
Agreement Total: $83,400,000.00
Term: 11/20/2006 – 06/30/2013

**Region: Fresno to Palmdale**
Contractor Name: URS, Hatch Mott MacDonald & ARUP a Joint Venture
Agreement Total: $119,985,612.00
Term: 02/12/2007 – 06/30/2012

**Region: Palmdale to Los Angeles**
Contractor Name: Hatch Mott MacDonald, URS, & ARUP a Joint Venture
Agreement Total: $74,288,000.00
Term: 12/29/2006 – 06/30/2012

**Region: Los Angeles to Orange County**
Contractor Name: STV Incorporated
Agreement Total: $21,400,000.00
Term: 12/29/2006 – 06/30/2012

**Region: Los Angeles to San Diego**
Contractor Name: HNTB Corporation
Agreement Total: $94,805,692.00
Term: 02/12/2007 – 06/30/2012

**Region: Altamont Corridor Rail Project**
Contractor Name: AECOM USA Inc.
Agreement Total: $55,000,000.00
Term: 11/12/2008 – 06/30/2014

## Other Contracts

### Visual Simulation

Contractor Name:
Newlands & Company, Inc.
Agreement Total: $5,000,000.00
Term: 11/15/2006 – 06/30/2012

The Contractor is responsible for the development of realistic visual and audio simulations that will enable the public, agencies and decision-makers to understand the virtual experience of a high-speed train system in California.

### Financial Services

Contractor Name: Infrastructure Management Group, Inc.
Agreement Total: $4,000,000.00
Term: 11/15/2006 – 06/30/2012

The Contractor is responsible for the preparation of a Financing Plan which includes a financing strategy and model for the implementation of the California high-speed train system. Additionally the Contractor will provide on-call advice and analysis to the authority on changes and new development to funding strategies, sources and availability.

### Legal Services

Contractor Name: Nossaman LLP
Agreement Total: $500,000.00
Term: 02/28/2009 – 06/30/2011

The Authority retained outside legal counsel to provide legal assistance concerning major infrastructure financing, implementation and project delivery, including public-private partnerships, as well as legal assistance concerning changes to and/or compliance with federal railroad regulations.

## Oversight

In addition to contracting for a Program Management Oversight (PMO) team to oversee the work of the Program Management Team (PMT), the Authority takes a series of steps that help ensure contracts are written to prescribe specific deliverables and that those items/ services are indeed delivered. The Authority works with the state Department of General Services to executive effective contracts, and in addition to PMT monitoring of deliverables, Authority staff tracks invoices, deliverables, and program schedules. In the Authority's planned organizational changes, additional state staff positions are envisioned for oversight and risk management.

## The Program Management Team

California's high-speed rail system is being developed with the assistance of a group of the world's leading experts in high-speed train planning, construction, and operation. These experts have guided the planning, construction, and/or operation of high-speed train systems around the world, representing hundreds of billions of dollars in infrastructure development. The Authority has enlisted many of the world's most experienced private engineering and planning firms to assist in:

- Program Management
- Project Engineering
- Economic Consulting
- Energy Consulting
- Environmental Services
- Infrastructure Design
- Systems, Operations and Ridership
- Right-of-Way and Land Use
- Specialty Engineering
- Transportation Planning
- Constructability Reviews
- Procurement
- Construction Management
- Testing & Commissioning
- Revenue Service Start-up

A brief summary of the Authority's consultant team experience is shown in the box below. In 2006, the Authority engaged Parsons Brinckerhoff[13] to provide program management services to oversee and manage the California High-Speed Rail Program. The Program Manager is providing program-level management and oversight of eight regional consulting firms that are performing detailed planning, preparing project-level environmental documents, conducting public outreach and engagement, and performing preliminary engineering design. Each of the regional consultants reports to a regional



13 In October 2009, Parsons Brinckerhoff was acquired by international engineering, construction and investment group Balfour Beatty.

manager from the program management team. The regional managers are directing the project-level environmental process and preliminary engineering design by the regional consultants, and will manage procurement, construction management, testing commissioning, and revenue start-up activities within their sections once this aspect of the program commences.

Successful management of a very large and complex undertaking like California's high-speed train project requires thoughtful planning, proactive decision-making, timely execution, and regular monitoring. As delivery activities overlap and schedules compress, the challenge is to consider and manage a number of separate, often concurrent, activities for different geographical sections and delivery phases of the system, including:

- Planning, environmental review and permitting; preliminary engineering, land acquisition, and negotiations with existing railroads, public and local entities
- Procurement documents, design, construction, testing and commissioning; and training
- Revenue service operation and maintenance of the high-speed rail system

The PMT has established standards for design work, environmental protocols, and revenue and ridership analysis, and manages the regional consulting firms under direct contract with the Authority. These standards are based on worldwide state-of-the-art high-speed rail experience and U.S. federal and state regulatory requirements to build and operate the Nation's first very-high-speed rail system.

**THE CHSTP TEAM**

More than 600 persons are currently involved in the planning and engineering of the CHSTP, including more than 135 senior managers, planners, engineers, and operators with significant project work on one or more of the high-speed train projects in Europe and Asia, as well as the Northeast Corridor. Examples of some of these projects and corresponding number of team members are shown below:

| | |
|---|---|
| **British HSR Projects:** | 21 |
| **Chinese HSR Projects:** | 1 |
| **Taiwan-Taipei-Kaohsiung:** | 23 |
| **Korea-Seoul-Pusan:** | 7 |
| **USA-North East Corridor:** | 65 |
| **Boston-New Haven, Electrification:** | 4 |
| **French TGV Projects:** | 2 |
| **HSL Zuid-Belgium-Netherlands:** | 2 |
| **Germany-ICE HSR:** | 2 |
| **Denmark Storebaelt & Oresund Links:** | 3 |
| **Portugal Linha do Norte:** | 2 |
| **Spanish HSR Projects:** | 3 |

Experts on this project have guided the planning, construction and/or operation of HST systems around the world representing hundreds of billions of dollars in infrastructure development.

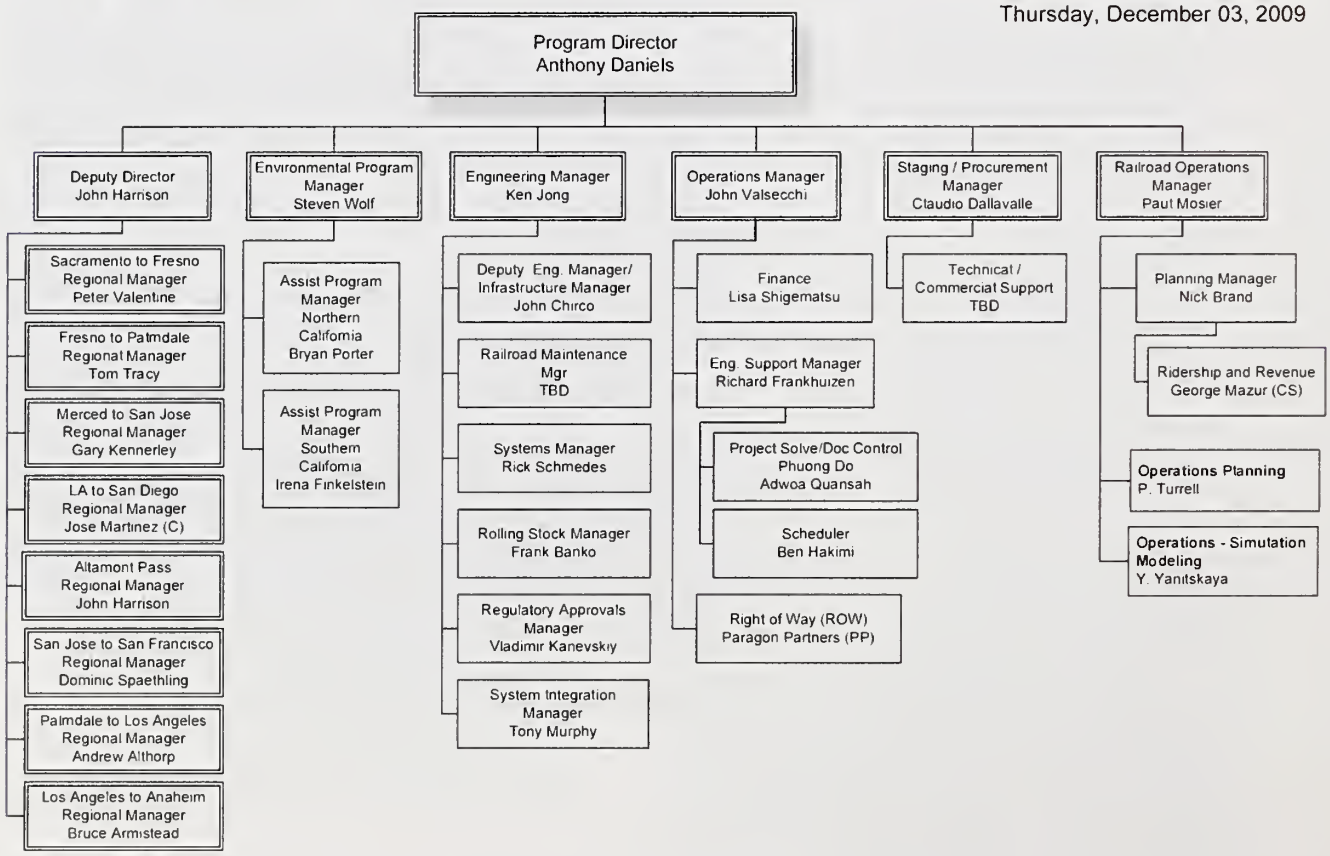
*(View Appendix A to this section that shows the Program Management Team's personnel and their relevant experience on high-speed train projects around the globe.)*

The PMT is responsible for taking the program from environmental assessment through preliminary engineering into procurement. A PMT will then follow the project into final design and construction, testing and commissioning, start-up, and revenue service. The overall schedule for the PMT's activities is shown later in this report.

The PMT, having established the standards and protocols, then reviews and confirms the work of the regional consulting firms for consistency and accuracy to ensure the system will function as intended. Once the project milestones are reached for 30 percent design and environmental approval, the PMT will create camera-ready documents for procurement of final design and construction contracts.

The current PMT organization is shown below. Led by Program Director (Daniels), reporting through Deputy Director (Harrison), eight Regional Managers oversee the Regional Consultants. Five other functional managers also report to the Director – an environmental program manager (Wolf); an engineering manager (Jong); an operations manager (Valsecchi); a staging/procurement manager (Dallavalle); and a railroad operations manager (Mosier). Each of these functional managers is supported by the staff shown.

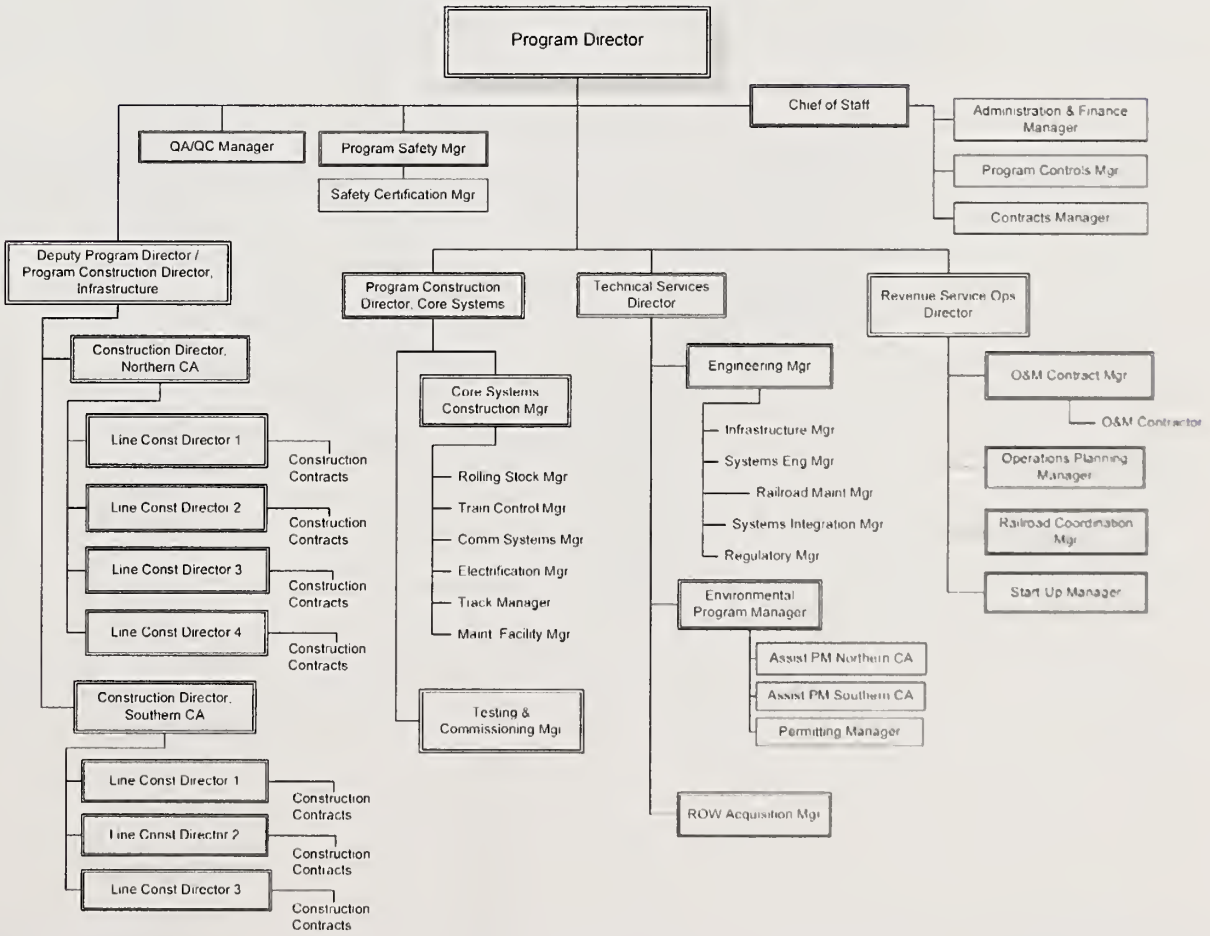
## Program Management Team



The current organization will grow as necessary to carry out the needs of the project through project-level environmental review to 30 percent design completion. The Authority's program manager will manage project construction from 30 percent design through launch of revenue service. Discussed and shown below is one possible scenario in which the final design and construction management team builds from the existing base of the program management team. Regional Managers would remain in charge of the work in their section, acquiring additional staff as needed to manage the right-of-way work, the final design/ construction, testing and commissioning and revenue service start-up.

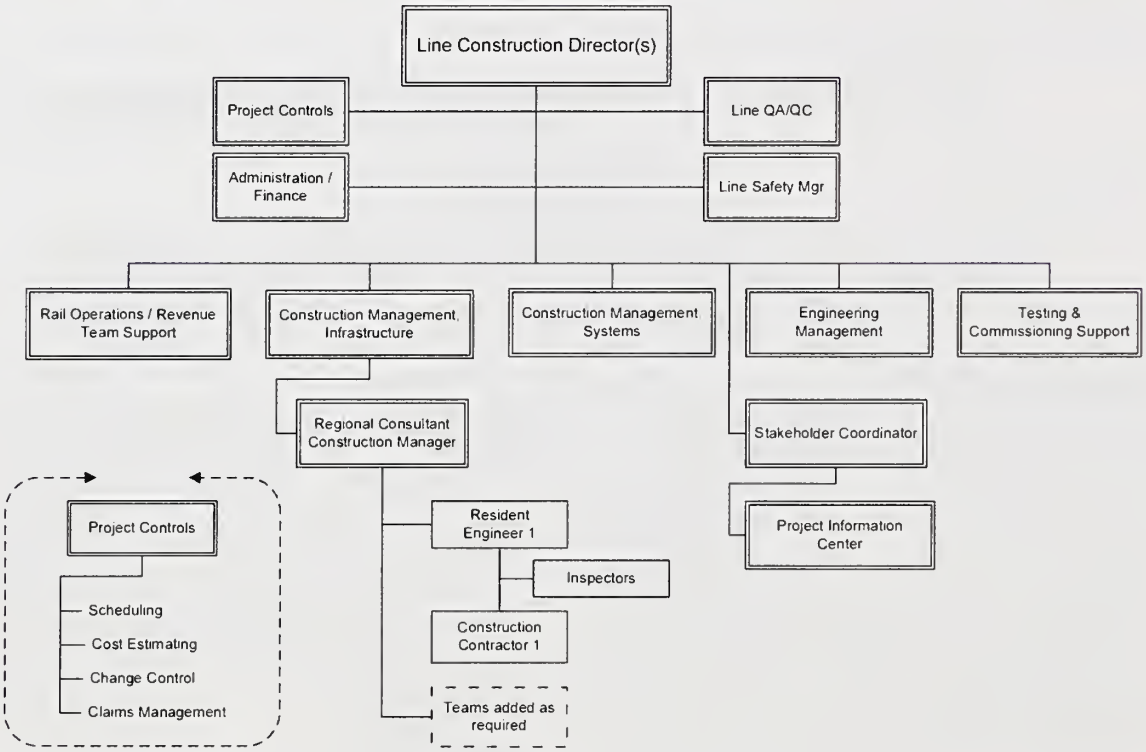
Led by a Program Director with seven direct reports, the PMT organization as depicted below for the final design and construction phase will be structured to provide both headquarters and field office staffs responsible for managing final design/construction and the operations & maintenance (O&M) contract procurement and administration, right-of-way (ROW) acquisition, construction management, engineering and environmental management, safety, quality assurance/quality control (QA/QC), program administration, program controls, testing & commissioning, revenue service start-up, and planning/oversight of the O&M of the completed system.

## PMT Design & Construction Phase Organization

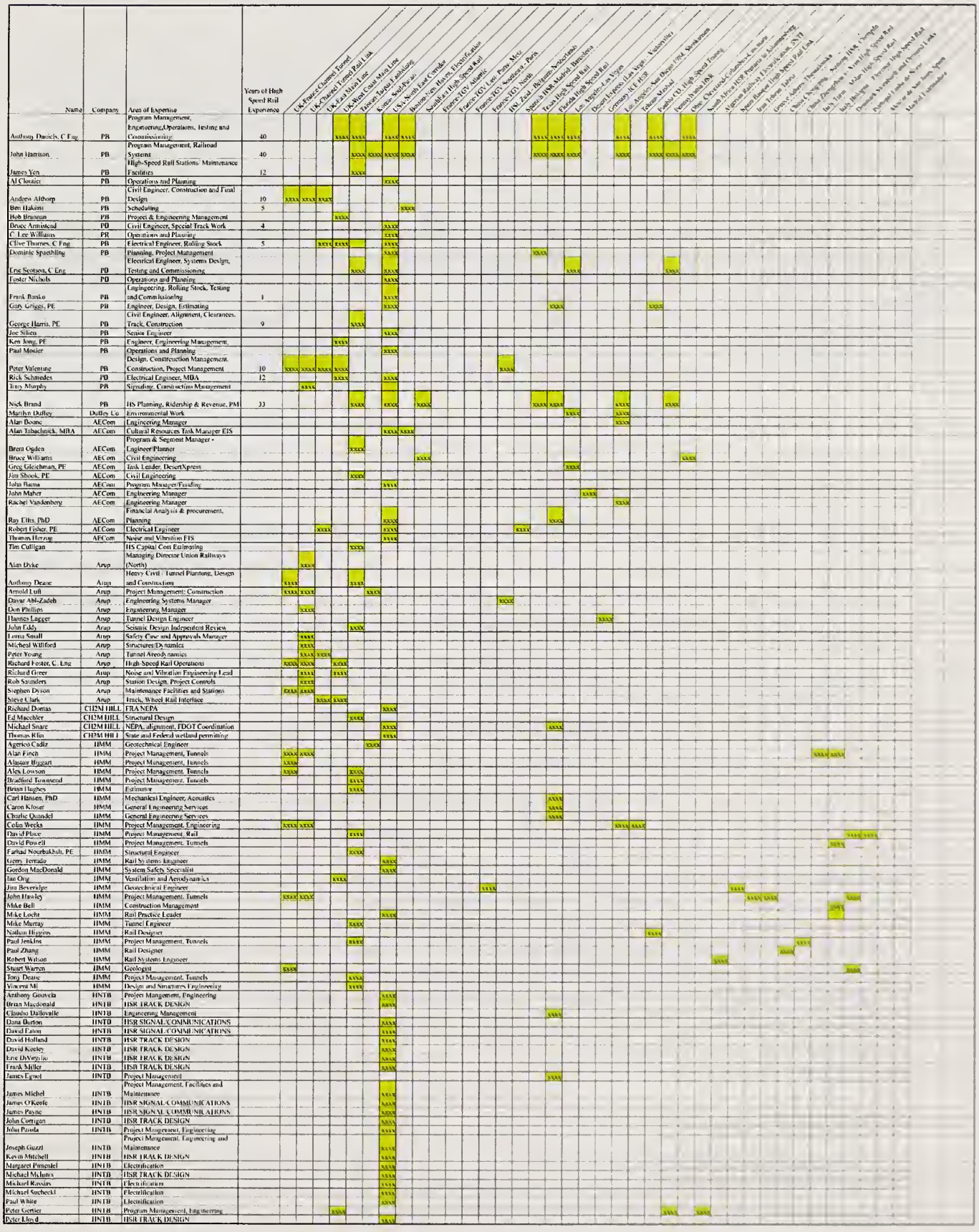


Design and construction of the core systems will be managed separately from the infrastructure design and construction. A core systems construction group will manage the rolling stock production, train control, communications systems, electrification, trackwork and maintenance facilities design and construction. A testing & commissioning group will also report to the Core Systems Program Construction Director. A Technical Services group will provide support to all the regions in the areas of engineering & design, environmental compliance & permitting, and right-of-way acquisition. Also a Revenue Service Operations Director will manage the O&M Contract, operations planning, railroad coordination, and start-up functions. System safety will be managed by a Program Safety Manager reporting to the Program Director. Configuration management will be the responsibility of the Program Controls Manager.

## Typical Regional Construction Organizations for Initial Sections



# Appendix A


Name
Company
Area of Expertise
Years of High Speed Rail Experience
UK-France Channel Tunnel
UK-Channel Tunnel Rail Link
UK-East Coast Line
UK-West Coast Main Line
Taiwan-Taipei-Kaohsiung
Korea-Seoul-Pusan
USA-North East Corridor
Boston-Washington, Electrification
Boston-New Haven, Electrification
Southeast High Speed Rail
France-TGV Atlantic
France-TGV Lyon-Paris Metz
France-TGV Southeast - Paris
France-TGV North
ENE Zuid - Belgium-Netherlands
Spanish HSR Madrid-Barcelona
Texas High Speed Rail
Florida High Speed Rail
Los Angeles-Las Vegas
Desert Express (Las Vegas - Victorville)
Germany ICE HSR
Las Angeles-San Diego (Mag Lev)
Tohoku-Shinkansen
Pendler CO. High Speed Training
Northern Italy HSR
Ohio - Cleveland-Columbus-Cincinnati
South Africa HSR Pretoria to Johannesburg
Algerian Railway Electrification SNTF
North Eastern High Speed Rail Link
Iran Tehran-Tabriz
Greece Athens-Thessaloniki
China Qinghuangdao - Shenyang HSR
Taiwan Zhongli - Nangang HSR
Italy Turin - Milan High Speed Rail
Italy Bologna - Milan High Speed Rail
Denmark Stockholm and Oresund Links
Portugal Lisbon - Oporto High Speed Rail
Morocco Tangier - Casablanca
Madrid Extension
Anthony Daniels, C Eng
PB
Program Management, Engineering,Operations, Testing and Commissioning
40
John Harrison
PB
Program Management, Railroad Systems
40
James Yen
PB
High-Speed Rail Stations' Maintenance Facilities
12
Al Cloutier
PB
Operations and Planning
Andrew Althorp
PB
Civil Engineer, Construction and Final Design
10
Ben Hakimi
PB
Scheduling
5
Bob Brannan
PB
Project & Engineering Management
Bruce Armistead
PB
Civil Engineer, Special Track Work
4
C. Lee Williams
PB
Operations and Planning
Clive Thorner, C Eng
PB
Electrical Engineer, Rolling Stock
5
Dominic Spaethling
PB
Planning, Project Management
Eric Scotson, C Eng
PB
Electrical Engineer, Systems Design, Testing and Commissioning
Foster Nichols
PB
Operations and Planning
Frank Banko
PB
Engineering, Rolling Stock, Testing and Commissioning
1
Gary Griggs, PE
PB
Engineer, Design, Estimating
George Harris, PE
PB
Civil Engineer, Alignment, Clearances, Track, Construction
9
Joe Silica
PB
Senior Engineer
Ken Jong, PE
PB
Engineer, Engineering Management,
Paul Mosier
PB
Operations and Planning
Peter Valentine
PB
Design, Construction Management, Construction, Project Management
10
Rick Schmedes
PD
Electrical Engineer, MBA
12
Tony Murphy
PB
Signaling, Construction Management
Nick Brand
PB
HS Planning, Ridership & Revenue, PM
33
Marilyn Duffey
Duffey Co
Environmental Work
Alan Doane
AECom
Engineering Manager
Alan Tabachnick, MBA
AECom
Cultural Resources Task Manager EIS
Brent Ogden
AECom
Program & Segment Manager - Engineer/Planner
Bruce Williams
AECom
Civil Engineering
Greg Gleichman, PE
AECom
Task Leader, DesertXpress
Jim Shook, PE
AECom
Civil Engineering
John Rama
AECom
Program Manager/Funding
John Maher
AECom
Engineering Manager
Rachel Vandenberg
AECom
Engineering Manager
Ray Ellis, PhD
AECom
Financial Analysis & procurement, Planning
Robert Fisher, PE
AECom
Electrical Engineer
Thomas Herzog
AECom
Noise and Vibration FIS
Tim Culligan
HS Capital Cost Estimating
Alan Dyke
Arup
Managing Director Union Railways (North)
Anthony Deane
Arup
Heavy Civil - Tunnel Planning, Design and Construction
Arnold Luft
Arup
Project Management; Construction
Davar Abi-Zadeh
Arup
Engineering Systems Manager
Don Phillips
Arup
Engineering Manager
Hannes Lagger
Arup
Tunnel Design Engineer
John Eddy
Arup
Seismic Design Independent Review
Lorna Small
Arup
Safety Case and Approvals Manager
Micheal Williford
Arup
Structures/Dynamics
Peter Young
Arup
Tunnel Aerodynamics
Richard Foster, C. Eng
Arup
High-Speed Rail Operations
Richard Greer
Arup
Noise and Vibration Engineering Lead
Rob Saunders
Arup
Station Design, Project Controls
Stephen Dyson
Arup
Maintenance Facilities and Stations
Steve Clark
Arup
Track, Wheel Rail Interface
Richard Dumas
CH2M HILL
FRA/NEPA
Ed Maechler
CH2M HILL
Structural Design
Michael Snare
CH2M HILL
NEPA, alignment, FDOT Coordination
Thomas Rhn
CH2M HILL
State and Federal wetland permitting
Agerico Cadiz
HMM
Geotechnical Engineer
Alan Finch
HMM
Project Management, Tunnels
Alastair Biggart
HMM
Project Management, Tunnels
Alex Lowson
HMM
Project Management, Tunnels
Bradford Townsend
HMM
Project Management, Tunnels
Brian Hughes
HMM
Estimator
Carl Hansen, PhD
HMM
Mechanical Engineer, Acoustics
Caron Kloser
HMM
General Engineering Services
Charlie Quandel
HMM
General Engineering Services
Colin Weeks
HMM
Project Management, Engineering
David Plaice
HMM
Project Management, Rail
David Powell
HMM
Project Management, Tunnels
Farhad Nourbakhsh, PE
HMM
Structural Engineer
Gerry Terrado
HMM
Rail Systems Engineer
Gordon MacDonald
HMM
System Safety Specialist
Ian Ong
HMM
Ventilation and Aerodynamics
Jim Beveridge
HMM
Geotechnical Engineer
John Hawley
HMM
Project Management, Tunnels
Mike Bell
HMM
Construction Management
Mike Loehr
HMM
Rail Practice Leader
Mike Murray
HMM
Tunnel Engineer
Nathan Higgins
HMM
Rail Designer
Paul Jenkins
HMM
Project Management, Tunnels
Paul Zhang
HMM
Rail Designer
Robert Wilson
HMM
Rail Systems Engineer
Stuart Warren
HMM
Geologist
Tony Deane
HMM
Project Management, Tunnels
Vincent Mi
HMM
Design and Structures Engineering
Anthony Gouveia
HNTB
Project Mangement, Engineering
Brian Macdonald
HNTB
HSR TRACK DESIGN
Claudio Dallovalle
HNTB
Engineering Management
Dana Burton
HNTB
HSR SIGNAL/COMMUNICATIONS
David Eaton
HNTB
HSR SIGNAL/COMMUNICATIONS
David Holland
HNTB
HSR TRACK DESIGN
David Keeley
HNTB
HSR TRACK DESIGN
Eric DiVerglio
HNTB
HSR TRACK DESIGN
Frank Miller
HNTB
HSR TRACK DESIGN
James Egnol
HNTB
Project Management
James Michel
HNTB
Project Management, Facilities and Maintenance
James O'Keefe
HNTB
HSR SIGNAL/COMMUNICATIONS
James Payne
HNTB
HSR SIGNAL/COMMUNICATIONS
John Corrigan
HNTB
HSR TRACK DESIGN
John Panola
HNTB
Project Mangement, Engineering
Joseph Guzzi
HNTB
Project Mangement, Engineering and Maintenance
Kevin Mitchell
HNTB
HSR TRACK DESIGN
Margaret Pimentel
HNTB
Electrification
Michael Mclinn
HNTB
HSR TRACK DESIGN
Michael Rossiter
HNTB
Electrification
Michael Sucheckl
HNTB
Electrification
Paul White
HNTB
Electrification
Peter Gertler
HNTB
Program Mantagement, Engineering
Peter Lloyd
HNTB
HSR TRACK DESIGN

# Appendix A - continued

| Name | Company | Area of Expertise | Years of High Speed Rail Experience | UK-France Channel Tunnel | UK-Channel Tunnel Rail Link | UK-East Main Line | UK-West Coast Main Line | Taiwan-Taipei Yanlyuang | Korea-Seul-Pusan | USA-North East Corridor | Boston-New Haven Electrification | SouthEast High Speed Rail | France-TGV Atlantic | France-TGV Eaux-Pierre-Metz | France-TGV Southeast - Paris | France-TGV North | HSL Zuid - Belgium-Netherlands | Spanish HSR-Madrid-Barcelona | Texas High Speed Rail | Florida High Speed Rail | Los Angeles-Las Vegas | Desert Express (Las Vegas - Victorville) | Germany-ICE HSR | Los Angeles-San Diego 1994 Shinkansen | Tehran-Mashad | Pueblo CO, High Speed Testing | Pennsylvania HSR | Ohio Cleveland-Columbus-Cincinnati | South Africa HSR Pretoria to Johannesburg | Algerian Railway Electrification, SNTF | Spain Basque High Speed Rail Link | Iran Tehran Tabriz | Greece Athens-Thessaloniki | China Changsha - Suizung HSR, Chengdu | China Zhengzhou to Xi'an High Speed Rail | Italy Turin - Milan High Speed Rail | Italy Bologna - Florence High Speed Rail | Denmark Storebaelt and Oresund Links | Portugal Lisbo de Norte | Alcazar de San Juan, Spain | Madrid Extremadura |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ralph Mazzeo | HNTB | HSR TRACK DESIGN | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Richard Jank | HNTB | HSR SIGNAL/COMMUNICATIONS | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Robert Erickson | HNTB | Electrification | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Steven Erekson | HNTB | HSR TRACK DESIGN | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Steven McElligott | HNTB | HSR TRACK DESIGN | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tina Joyce | HNTB | ELECTRIFICATION | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| William Sullivan | HNTB | HSR TRACK DESIGN | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| William Wells | HNTB | HSR SIGNAL/COMMUNICATIONS | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Eduardo Romo Urroz | Prointec | Project Management & HSR Track Design | | | | | | | | | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | xxxx | xxxx | |
| Raquel Perez | Prointec | Systems | | | | | | | | | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | xxxx | xxxx | |
| Brew Clarke | STV | Rail Engineering | 8 | | | | | | | xxxx | | | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | |
| Brewerton Clarke, PE | STV | Engineering Manager, Preliminary Design | | | | | | | | xxxx | | | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | |
| David Borger | STV | Industrial Engineering | 11 | | | | | | | xxxx | | | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | |
| Giri Taksali | STV | Bridge Engineering | 3 | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| John Johnson | STV | Industrial Engineering | 7 | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Marec Zamdmer | STV | Station Design | 6 | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mark Peterson | STV | Civil Engineering | 1 | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Robert Radlein | STV | Design and Construction Manager | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Robert Davidson | STV | Station Design | 6 | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tony Venturato, PE | STV | Vehicles / Train Controls | 6 | | xxxx | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bob Schaevitz | URS | Project Manager | | | | | | | | | | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | | |
| Rob Greene | URS | Noise/Vibration/EMF | | | | | | | | | | | | | | | | | | xxxx | | | | | | | | | | | | | | | | | | | | | | |
| Tom Baily | URS | Project Management, Environmental | | | | | | | | | | | | | | | | | xxxx | xxxx | | | | | | | | | | | | | | | | | | | | | | |
| 131 | | | Average | 12 | 17 | 6 | 11 | 22 | 3 | 64 | 4 | 2 | 0 | 0 | 0 | 1 | 2 | 3 | 7 | 16 | 5 | 1 | 2 | 7 | 1 | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 2 | 2 | |

# From Today to Passenger Service

The path from where California's high-speed train project is today to initial revenue passenger service can be divided into planning and implementation stages. Over the coming two years, the project will begin transitioning from the planning stage into the implementation stage. This section will describe the planning process, show where the project is currently within the projected timeline, and discuss the plan to achieve initial high-speed train service from San Francisco to Anaheim by 2020.

## The Process

The planning and implementation stages for the California High-Speed Train Project (CHSTP) include the following:

### Planning

Statewide Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS), Conceptual Engineering (completed)

- Bay Area to Central Valley Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS), Conceptual Engineering (initially completed in 2008; additional work in progress based on court ruling)
- Draft HST Section Project EIR/EIS, 15% Design – Preliminary Engineering (in progress)
- Final HST Section Project EIR/EIS, 30% Design – Preliminary Engineering (to follow Draft EIR/EIS)
- Notices of Determination (NODs) / Records of Decision (RODs)

### Implementation

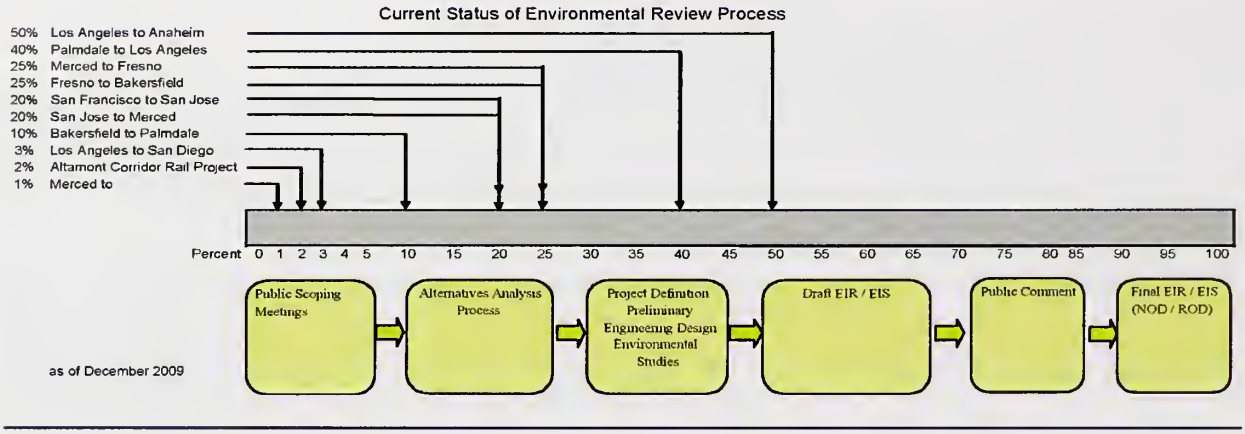
- Procurement Documents
- Permitting
- Land Acquisition and Right-of-Way Preservation
- Design and Construction
- Testing, Commissioning, and Training
- Start-up

### Planning

Planning for California's high-speed train began more than two decades ago. The Program EIR/EIS documents approved by the Authority and the FRA in 2005 and 2008 establish a solid basis for the current regional Project EIR/EIS's and preliminary engineering currently underway. Described below are the remaining steps to complete the environmental reviews and prepare for construction.

### Environmental Review

The environmental review process must be complete before a final project alignment can be chosen and before any construction can take place. The process is being conducted in accordance with the requirements of the National Environmental




Protection Act (NEPA) and the California Environmental Quality Act (CEQA). The federal lead agency responsible for NEPA compliance is the Federal Railroad Administration (FRA) and the California High-Speed Rail Authority (Authority) is the state agency responsible for CEQA. To satisfy both NEPA and CEQA, a combined environmental document is prepared – Environmental Impact Report (EIR) for CEQA and Environmental Impact Statement (EIS) for NEPA. The combined environmental document is referred to as an EIR/EIS.

Previously, largely due to the sheer size and scope of the high-speed train project, the Authority decided to conduct the environmental review in two parts – first with a statewide program-level review, and second with a more specific project-level review. After breaking the project into multiple sections, the project-level review is the current state of the project.

Two Program-Level EIR/EISs have already been prepared by the Authority: a Statewide EIR/EIS completed in 2005 and the Bay Area to Central Valley EIR/EIS completed in 2008[14]. These program level documents (available on-line at www.cahighspeedrail.ca.gov[15]) are the basis for the project specific environmental documents that are under preparation for the nine sections of the 800-mile high-speed train system and the Altamont Corridor Rail Project.

### Process

The Project EIR/EIS process begins with SCOPING. The Authority and FRA conduct public meetings called "scoping meetings" at selected locations within the study area to present the Program-Level alternatives and optional station sites, explain the environmental process, and receive comments from the public and agencies regarding any issues or concerns they may have related to the high-speed train project.

Prior to the scoping meeting, a NOTICE OF INTENT (NOI) is prepared and published by FRA in the Federal Register. The NOI describes the project background, alternatives, and potential environmental issues and provides the locations and dates for the scoping meetings. Under CEQA a similar notice, NOTICE OF PREPARATION (NOP) is prepared and filed with the State Clearinghouse and advertised in local newspapers.

During the environmental process it is important to coordinate with local, regional, state, and federal agencies to understand their environmental approval and permitting requirements. An AGENCY COORDINATION PLAN is prepared that identifies these agencies. The plan outlines the roles and responsibilities of these agencies and the project information that will be shared with them for comment. Letters of invitation are sent to these agencies to

14 As described previously, the Authority is conducting additional program-level work on the Bay Area to Central Valley EIR in compliance with a court judgment and will consider the entire record before it prior to certifying the revised EIR and making a new decision on the Bay Area/Central Valley link for the high-speed train system.
15 http://www.cahighspeedrail.ca.gov/library.asp?p=8224

seek agreement on their participation and their role in the project. Similar plans are prepared to facilitate public outreach, coordination with Native American Indian Tribes, and outreach to low-income and minority populations.

An ALTERNATIVES ANALYSIS (AA) is conducted to help identify the alignments and station locations to carry forward in the environmental review. It begins with a more detailed look at alternatives identified in the program-level EIR/EIS and development of additional alternatives and design options based on input received from the scoping meetings. These alternatives are further refined based on feedback received from public outreach and local planning, transportation, and resource agencies. The intent of the AA process is to define potentially feasible project alternatives, design options, and station locations that can meet the NEPA Purpose and Need and CEQA project objectives while avoiding or minimizing environmental impacts. The Purpose and Need Statement is a part of the NEPA process to document why a project is undertaken. This documentation lays the foundation for identifying and evaluating a reasonable set of alternatives to be considered in engineering and environmental studies that are used in preparing an EIR/EIS. During the AA process the project study area will be defined and the baseline environmental studies started.

A draft of the PROJECT DEFINITION/DESCRIPTION is prepared when the AA process is finished and is updated as engineering design reaches 15 percent completion. The draft project description will allow the preparation of the environmental impact analysis which will be completed as the 15 percent engineering design is prepared. Then the Authority proceeds with the preparation of TECHNICAL REPORTS and with the development of baseline conditions, impact analysis, and mitigation measures for the Draft EIR/EIS.

The DRAFT EIR/EISs will be circulated for public and agency review. A review period of 45 to 60 days will be provided to receive comments on the project alternatives, the preferred alternative (if identified in the Draft EIR/EIS), 15 percent engineering design, environmental issues, and mitigation measures. In public hearings the results of the Draft EIR/EIS documents will be presented and will be accepted regarding the project. Responses will be prepared for the comments received on the Draft EIR/EISs. Both the comments and responses will be presented as part of the Final EIR/EIS.

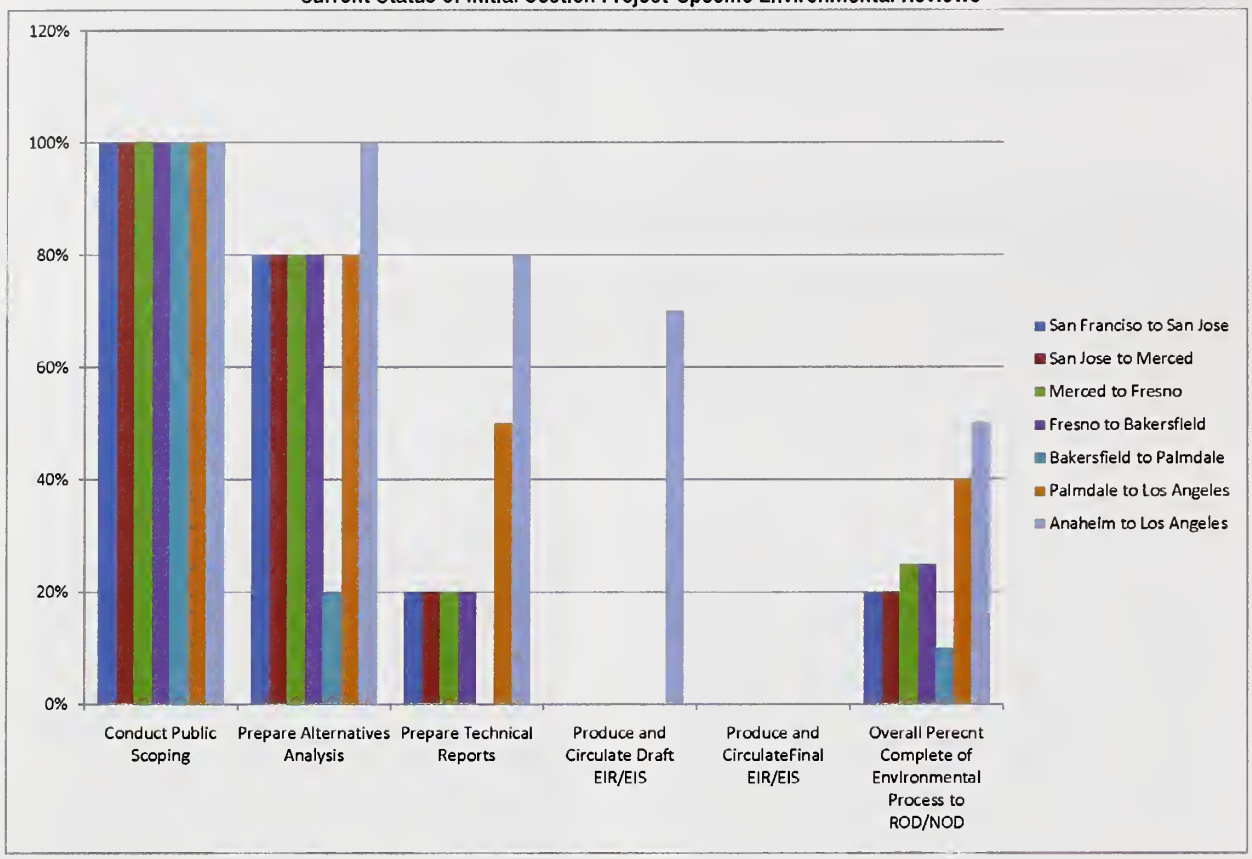
A FINAL EIR/EIS will be prepared for each high-speed train section. Upon being made available, the final EIRs/EISs will be ready for consideration and certification by the Authority at a noticed public meeting of the Authority board, in conjunction with decisions on final alignments and station locations for each section of the train system. At the conclusion of the process, the Authority will file a NOTICE OF DETERMINATION (NOD) for the decisions it makes related to each Final EIR. The FRA will make the Final EIRs/EISs available for a 30-day period prior to issuing a RECORD OF DECISION (ROD). The FRA's RODs and the Authority's final decisions will include commitments to mitigation measures to be implemented in the construction and operations of the project and will identify the subsequent environmental permitting that will be required during the next phases of design and construction.

### Current Status of Project EIR/EIS

The environmental process for each of the high-speed train project sections in both initial and subsequent phases has been initiated. The status of the work prepared for each section as of December 1, 2009, is shown in the exhibits below and summarized as follows[16].

16 As noted above, the Authority is undertaking revision and recirculation of a portion of its Bay Area to Central Valley Program EIR and will consider the revised material prior to making a new programmatic decision for connecting the Bay Area to the Central Valley. The new decision has the potential to affect some project EIRs.

**Exhibit 1:**
**Current Status of Initial Section Project-Specific Environmental Reviews**



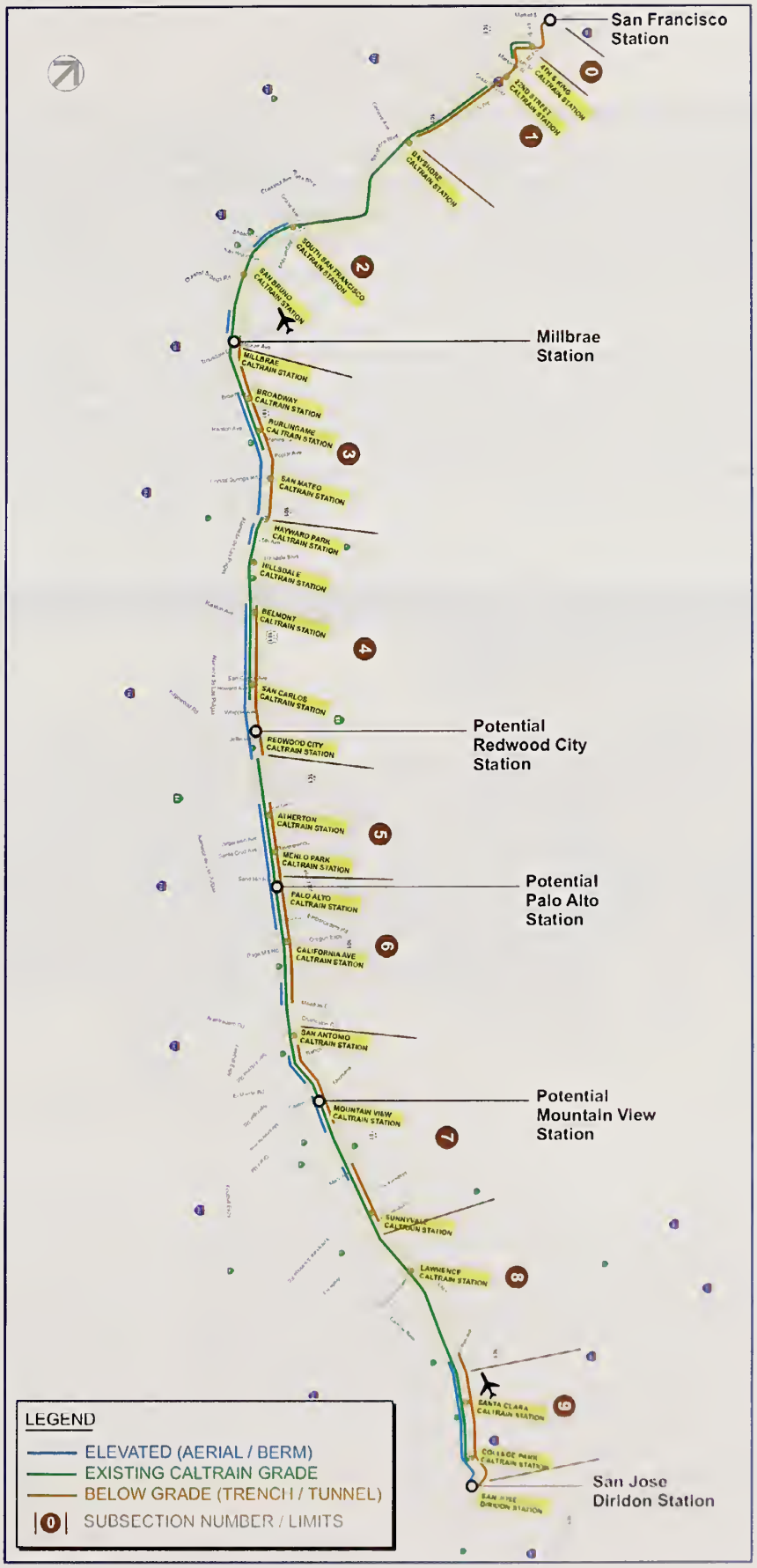

## Phase 1 Sections

### San Francisco to San Jose Section:

Scoping was initiated in December 2008. Three scoping meetings were held in San Mateo County, San Francisco, and Santa Clara County in January 2009. Since then, working in cooperation with the Peninsula Corridor Joint Powers Board (Caltrain), the Authority has benefited from significant community participation in the identification and refinement of alignment and at-grade, aerial and tunnel design options in this corridor, which extends from the planned Transbay Terminal in San Francisco to Diridon Station in downtown San Jose. Based on significant engineering, right-of-way and environmental work, these options have been evaluated using Authority criteria to identify a set of technically viable alternatives for study in the project EIR/EIS. Figure SFSJ shows the location of the alignments and options to be studied in the environmental document. The AA process is underway and is expected to be completed in early 2010.

Current overall percent complete to NOD/ROD is currently estimated to be 20 percent. Target NOD/ROD date: September 2011.

Figure SFSJ

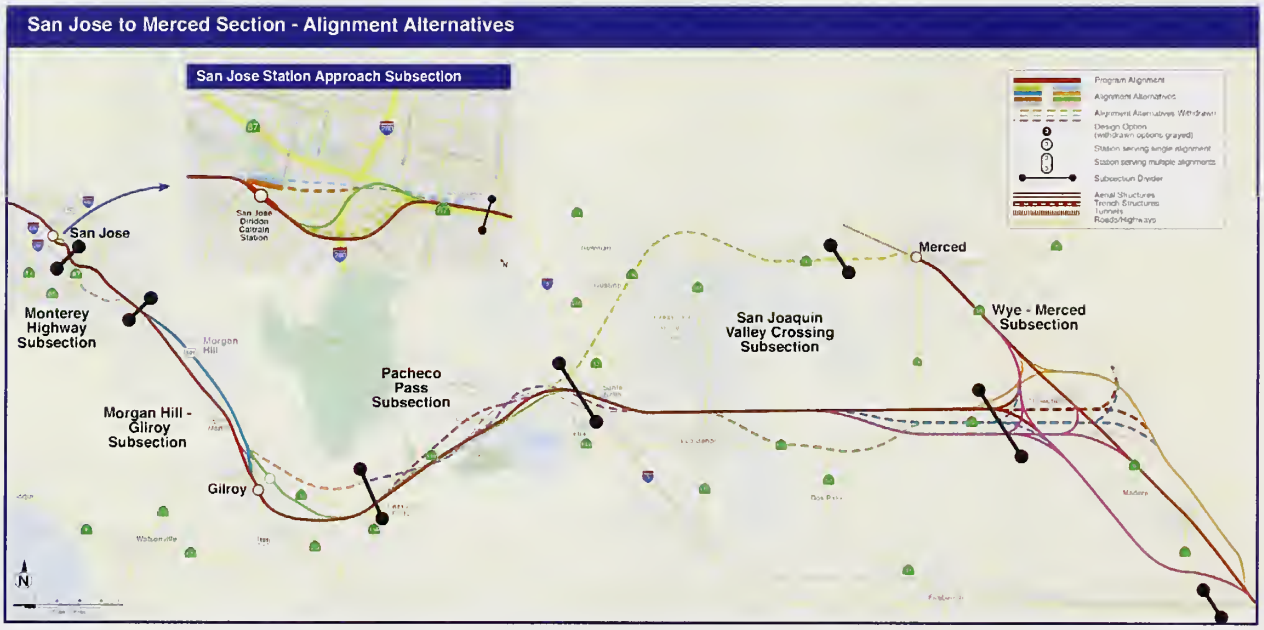

San Francisco Station
Millbrae Station
Potential Redwood City Station
Potential Palo Alto Station
Potential Mountain View Station
San Jose Diridon Station
LEGEND
ELEVATED (AERIAL / BERM)
EXISTING CALTRAIN GRADE
BELOW GRADE (TRENCH / TUNNEL)
SUBSECTION NUMBER / LIMITS

## San Jose to Merced Section:

Scoping was initiated in March 2009. Scoping meetings were held in San Jose, Merced, and Gilroy in March 2009. Based on scoping and information from the Bay Area to Central Valley Program EIR/EIS, a large number of alignment and at-grade, vertical, and tunnel design options were identified. For ease of analysis, the section was divided into six subsections: downtown San Jose, Monterey Highway, Morgan Hill-Gilroy, Pacheco Pass, crossing the San Joaquin Valley, and the Wye connection near Merced.

Engineering, right-of-way requirements, constructability issues, environmental constraints, and neighborhood concerns were all considered in sifting through more than 30 alignment and design options to arrive at a reduced set of alignment and options that the Authority and FRA have agreed be evaluated in the project EIR/EIS (see Figure SJM) The AA process is underway and is expected to be completed in early 2010. Current overall percent complete to NOD/ROD is estimated to be 20 percent. Target NOD/ROD date: March 2012.

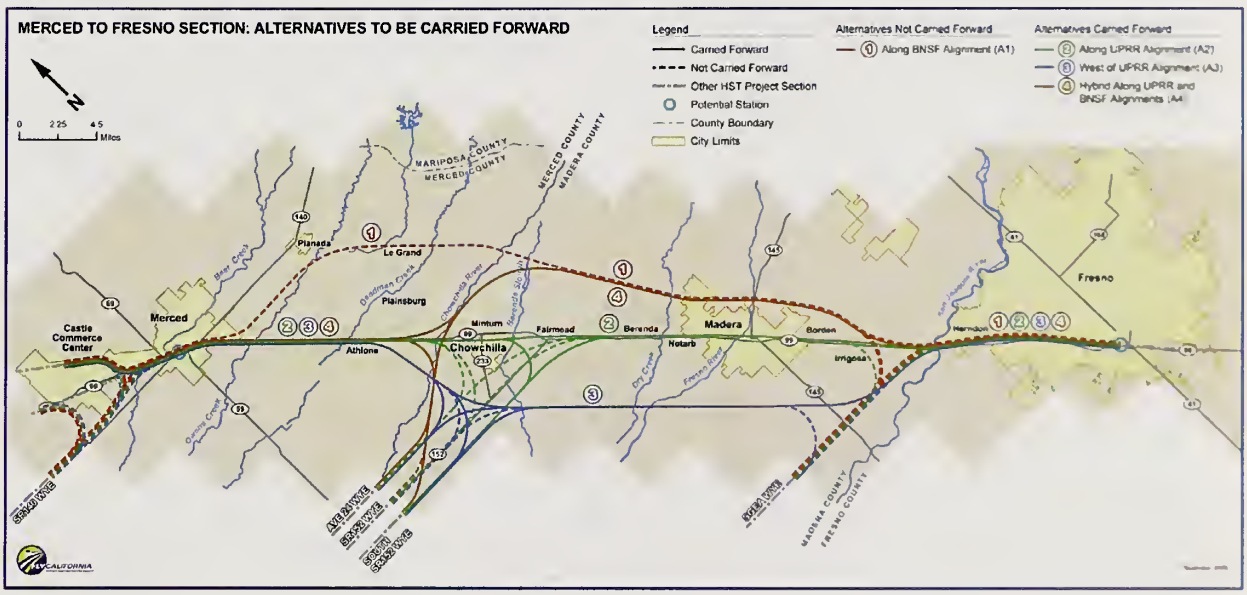
Figure SJM



## Merced to Bakersfield Section:

Scoping was initiated in February 2009. Scoping meetings were held in Merced, Madera, Fresno, Visalia, and Bakersfield in March 2009. Since then, FRA and the Authority determined that the environmental effects of the high-speed train from Merced to Bakersfield were more appropriately assessed in two separate documents – one for Merced to Fresno and another for Fresno to Bakersfield. As a result, an amended NOI and NOP were issued in October 2009. In June, the FRA and Authority agreed that four north-south alignments be carried forward and evaluated in the Alternatives Analysis process. The four north-south alignments and the five alignments under study by the San Jose to Merced section created 20 possible junction (wye) configurations. Based on additional field work, engineering, and environmental review, the alignments, wyes, station location and design options were further evaluated using more detailed evaluation criteria. The results of this work were then shared with the FRA and the Authority, resulting in an agreement that three north-south alternatives and four wye connections with the San Jose to Merced section be studied as part of the environmental evaluation process (see Figure MF)

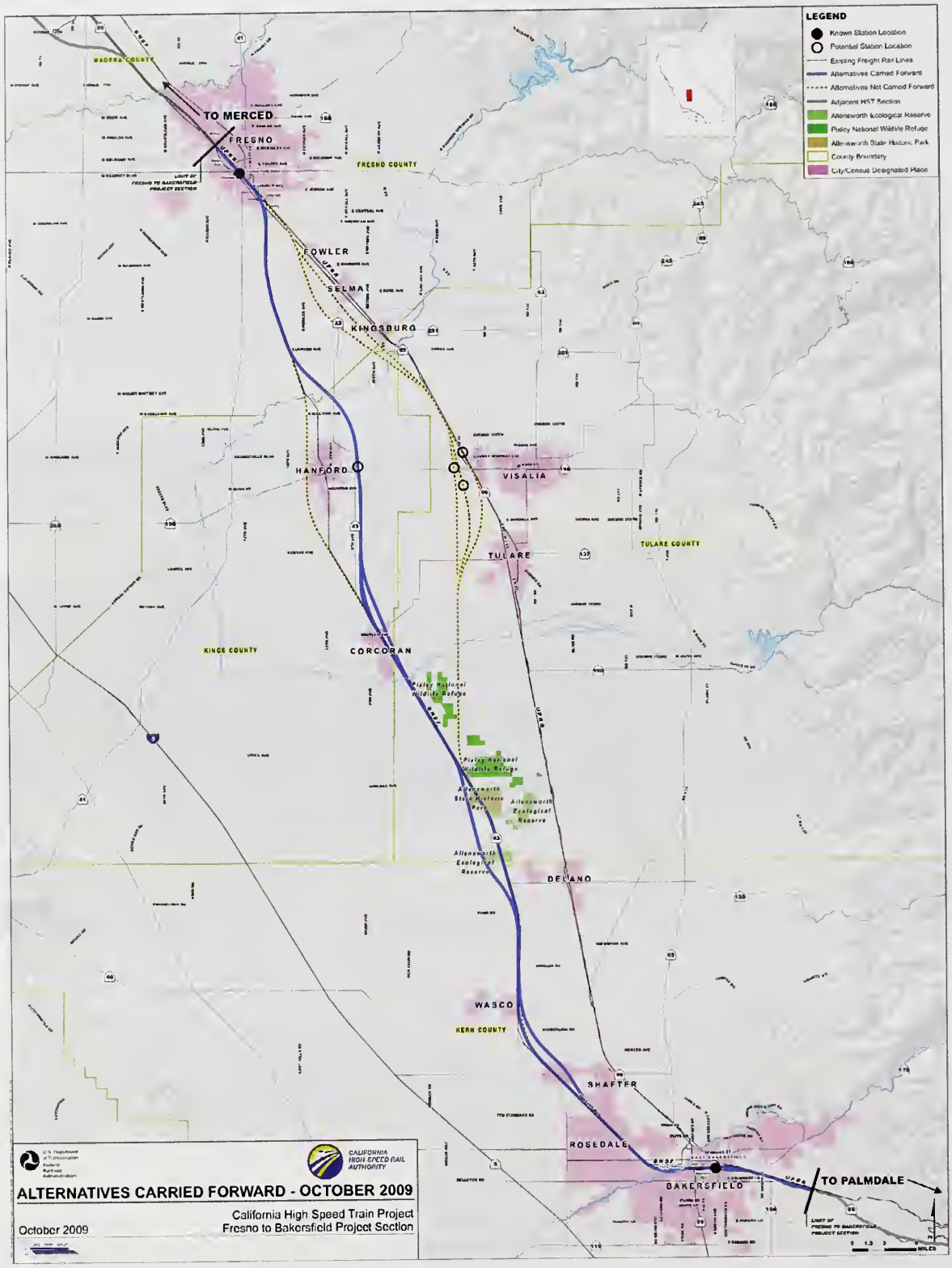
Figure MF




## Fresno to Bakersfield Section:

A similar process was followed for the subsection between Fresno to Bakersfield. Through downtown Fresno, 12 alternative alignments – combinations of route and vertical profile (elevation) – were identified and studied. Between Fresno and Bakersfield, two corridors, three route alignments, and a number of design options were considered. Reaching Bakersfield, the project team considered two main route alternatives. Based on engineering analysis, consideration of environmental issues, and comments received from local officials, resources agencies, and the general public, the Authority and FRA agreed that two north-south alignment alternatives with some design options be evaluated in the EIR/EIS (see Figure FB). The AA process is underway for both the Merced to Fresno and Fresno to Bakersfield Projects and is expected to be completed in December 2009. Current overall percent complete to NOD/ROD for both projects is currently estimated to be 25 percent. Target both NOD/ROD dates: September 2011.

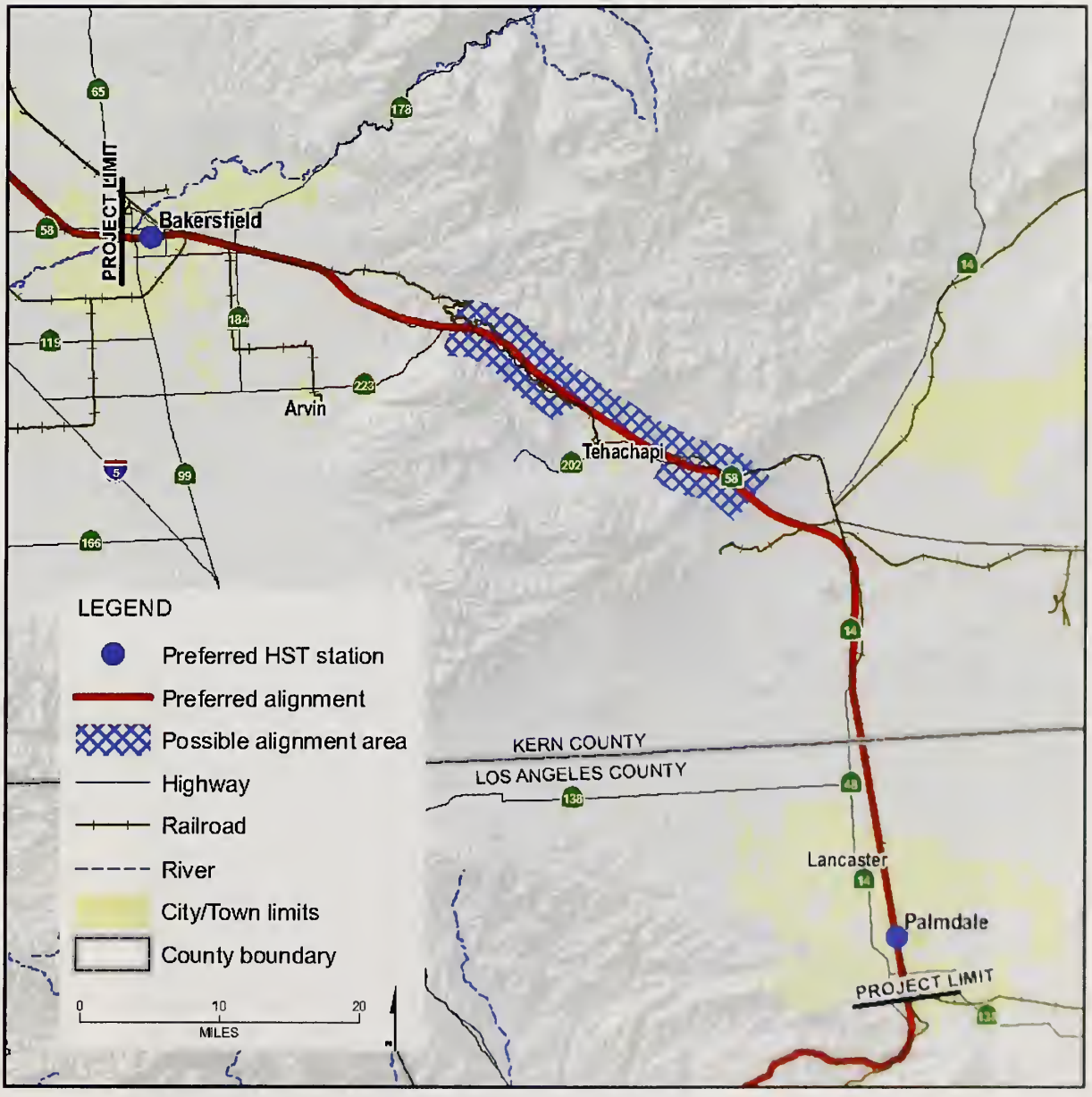
Figure FB


LEGEND
Known Station Location
Potential Station Location
Existing Freight Rail Lines
Alternatives Carried Forward
Alternatives Not Carried Forward
Adjacent HST Section
Allensworth Ecological Reserve
Pixley National Wildlife Refuge
Allensworth State Historic Park
County Boundary
City/Census Designated Place
MADERA COUNTY
TO MERCED
FRESNO
FRESNO COUNTY
FOWLER
SELMA
KINGSBURG
HANFORD
VISALIA
TULARE
TULARE COUNTY
KINGS COUNTY
CORCORAN
DELANO
WASCO
KERN COUNTY
SHAFTER
ROSEDALE
BAKERSFIELD
TO PALMDALE
CALIFORNIA HIGH-SPEED RAIL AUTHORITY
ALTERNATIVES CARRIED FORWARD - OCTOBER 2009
October 2009
California High Speed Train Project
Fresno to Bakersfield Project Section

**Bakersfield to Palmdale Section:**

Scoping was initiated in September 2009. Scoping meetings were held in Bakersfield, Tehachapi, and Palmdale in September 2009. From these scoping meetings, as well as discussions with local officials and community groups, the project team is now defining the range of study alternatives to be considered during the Alternatives Analysis process. This section of the high-speed train system will require crossing the Tehachapi Mountains. As a result, significant engineering work has already occurred to identify alignment alternatives that meet the Authority's design criteria. Field work is also underway to identify environmental constraints associated with alignment and design options. Figure BP shows the alignments identified during the public scoping process. The AA process is expected to be completed in the summer of 2010. Current overall percent complete to NOD/ROD is estimated to be 10 percent. Target NOD/ROD date: October 2012.

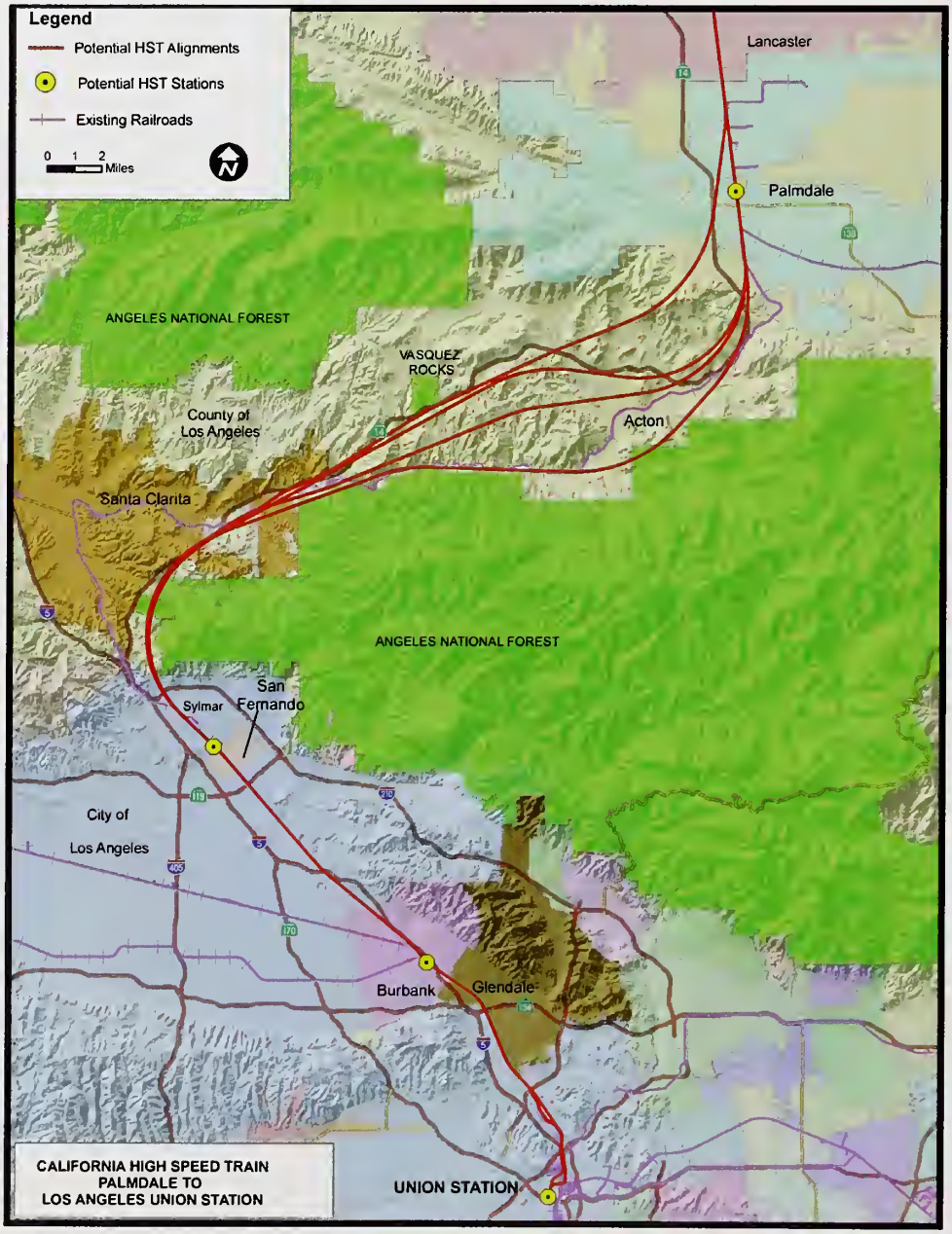
Figure BP



### Palmdale to Los Angeles Section:

Scoping was initiated in March 2007. Scoping meetings were held in Los Angeles, Glendale, Sylmar, and Palmdale in April 2007. Since then, significant engineering and environmental work has been accomplished, including the evaluation of access into and out of Los Angeles Union Station. A combination of at-grade, aerial and tunnel options have been considered, resulting in the initial identification of 15 alignment and design options. Right-of-way constraints, potential land-use impacts, constructability issues, and other factors have resulted in the Authority and FRA identifying three basic alignments that are likely to be carried forward for analysis in the project EIR/EIS (see Figure PLA). The AA process is well underway and the environmental technical reports are being prepared. The Administrative Draft EIR/EIS is expected to be completed in December 2010. Current overall completion to NOD/ROD is estimated to be 40 percent. Target NOD/ROD date: December 2011.

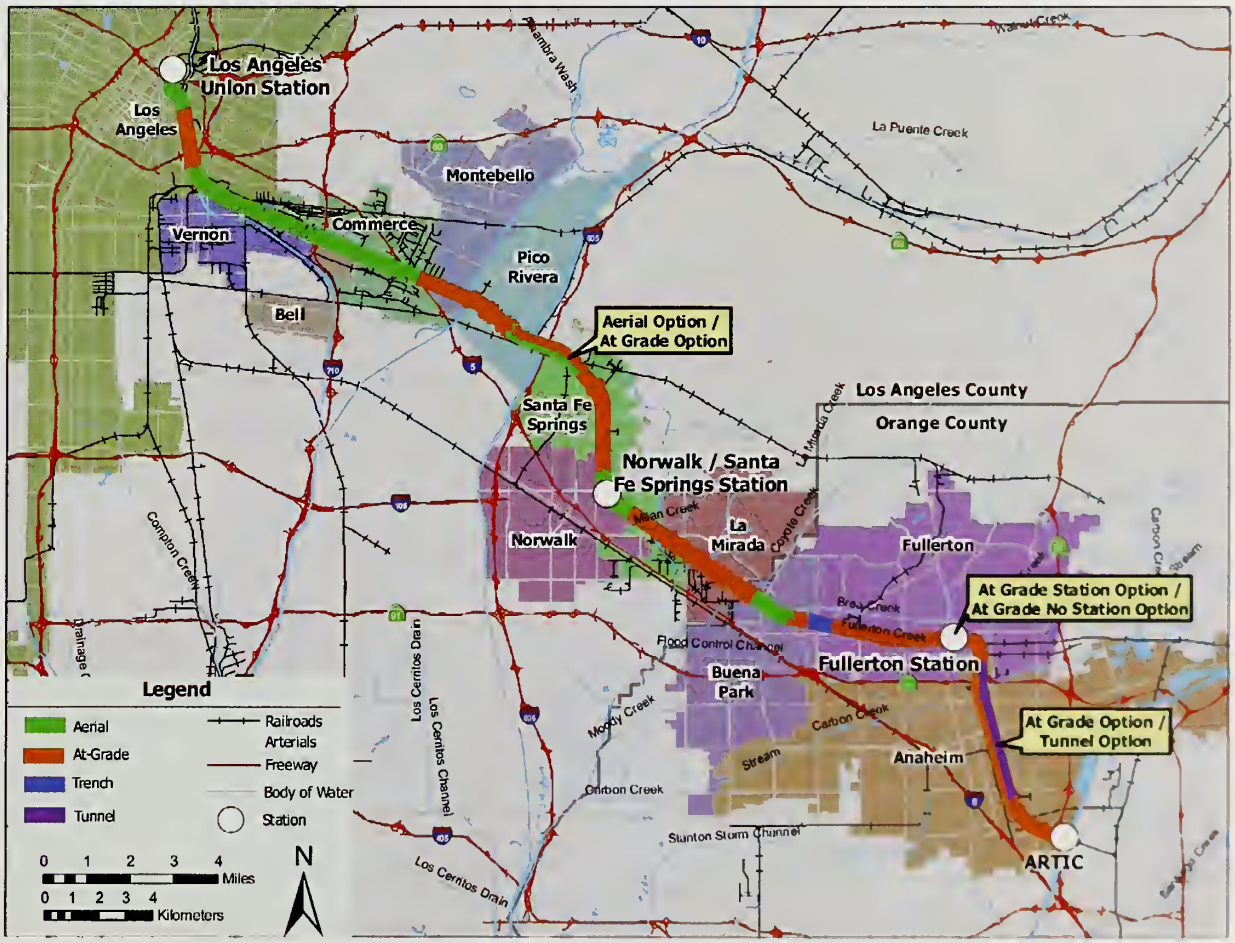
Figure PLA



## Los Angeles to Anaheim Section:

Scoping was initiated in March 2007. Three scoping meetings were held in Los Angeles, Norwalk, and Anaheim in April 2007. Working in cooperation with LA MTA, significant engineering and environmental work has been accomplished to identify and evaluate existing and future rail passenger and freight operations within the section, access into and out of Los Angeles Union Station (LAUS), design options for connecting with the planned Anaheim Regional Transportation Intermodal Center (ARTIC), a possible station in Fullerton, and alternative maintenance facility sites near LAUS and ARTIC. The AA process and the environmental technical reports have been completed and the Administrative Draft EIR/EIS is in preparation, expected to be completed in January 2010. Current overall percent complete to NOD/ROD is estimated to be 50 percent. Target NOD/ROD date: March 2011. (see Figure LAA)

Figure LAA

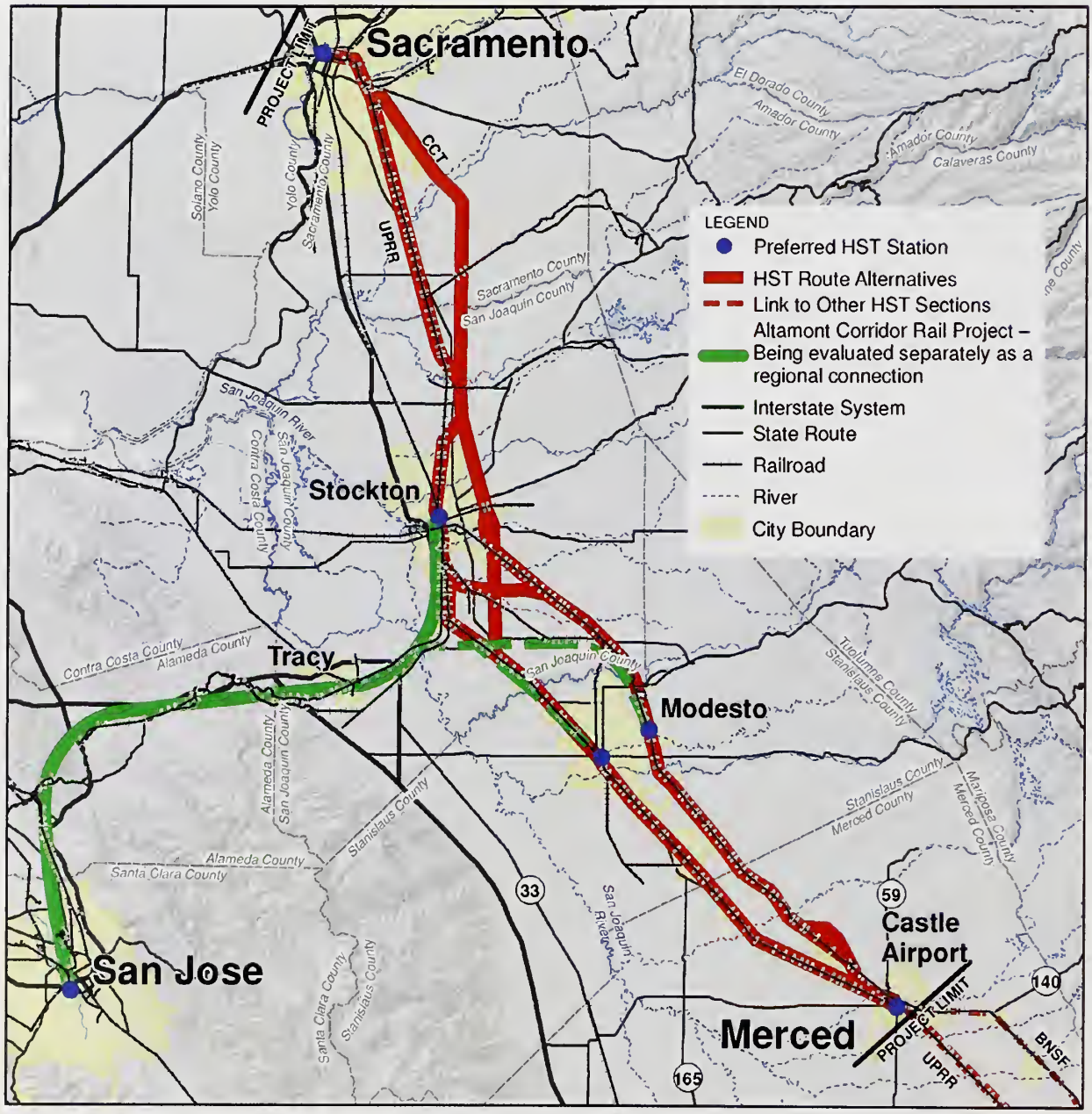


## Subsequent Sections

### Merced to Sacramento Section:

The NOI/NOP will be issued in December 2009. Scoping is planned to start in January 2010, with scoping meetings to be held in Sacramento, Stockton, Modesto, and Merced. Significant engineering and environmental work will then follow with the AA process to be completed in August 2010. Work will then be initiated on preparation of the project EIR/EIS. Current overall percent complete to NOD/ROD is estimated to be 1 percent. At this early stage, it is envisioned that the environmental review would be completed no sooner than 2014, with construction to begin no sooner than 2015. (see Figure MS)

Figure MS



## Los Angeles to San Diego Section:

Scoping was initiated in October 2009. Scoping meetings were held in La Jolla, San Diego, Escondido, Murrieta, Corona, Riverside, Monterey Park, West Covina, El Monte, and Pomona in October 2009 and also Ontario and San Bernardino in November 2009. Public participation at these meetings was significant, with over 1,900 comments received addressing alignment, engineering, and environmental issues. Over the next year, substantial work will occur to identify the range of alternatives suitable for study in the project EIR/EIS. The AA process was started in November 2009 and will be completed in the fall of 2010. Current overall percent complete to NOD/ROD is estimated to be 3%. At this early stage, it is envisioned that the environmental review would be completed no sooner than 2016, with construction to begin no sooner than 2017. (see Figure LASD)

Figure LASD

### Altamont Corridor Rail Project:

This is a partnership, separate from the high-speed train system, that the Authority is pursuing with local and regional transit agencies to develop a joint-use rail infrastructure project between the Central Valley and the Bay Area via the Altamont Pass. Scoping was initiated in November 2009, with sessions held in Livermore, Stockton, Fremont, and San Jose. The AA process will be initiated in December 2009 and is expected to be completed in the summer of 2010. Current overall percent complete to NOD/ROD is estimated to be 2%. At this early stage, it is envisioned that the environmental review would be completed no sooner than 2014, with construction to begin no sooner than 2015.
(see Figure ALT)

Figure ALT

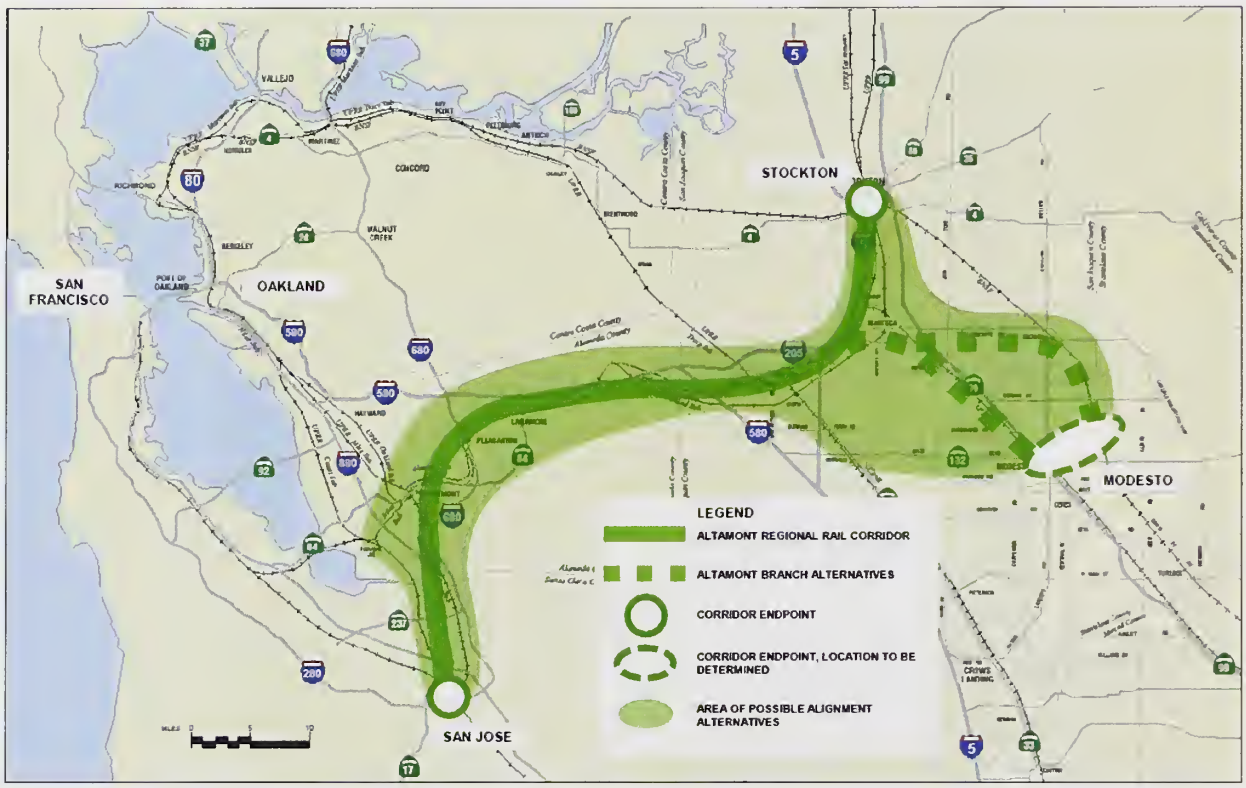
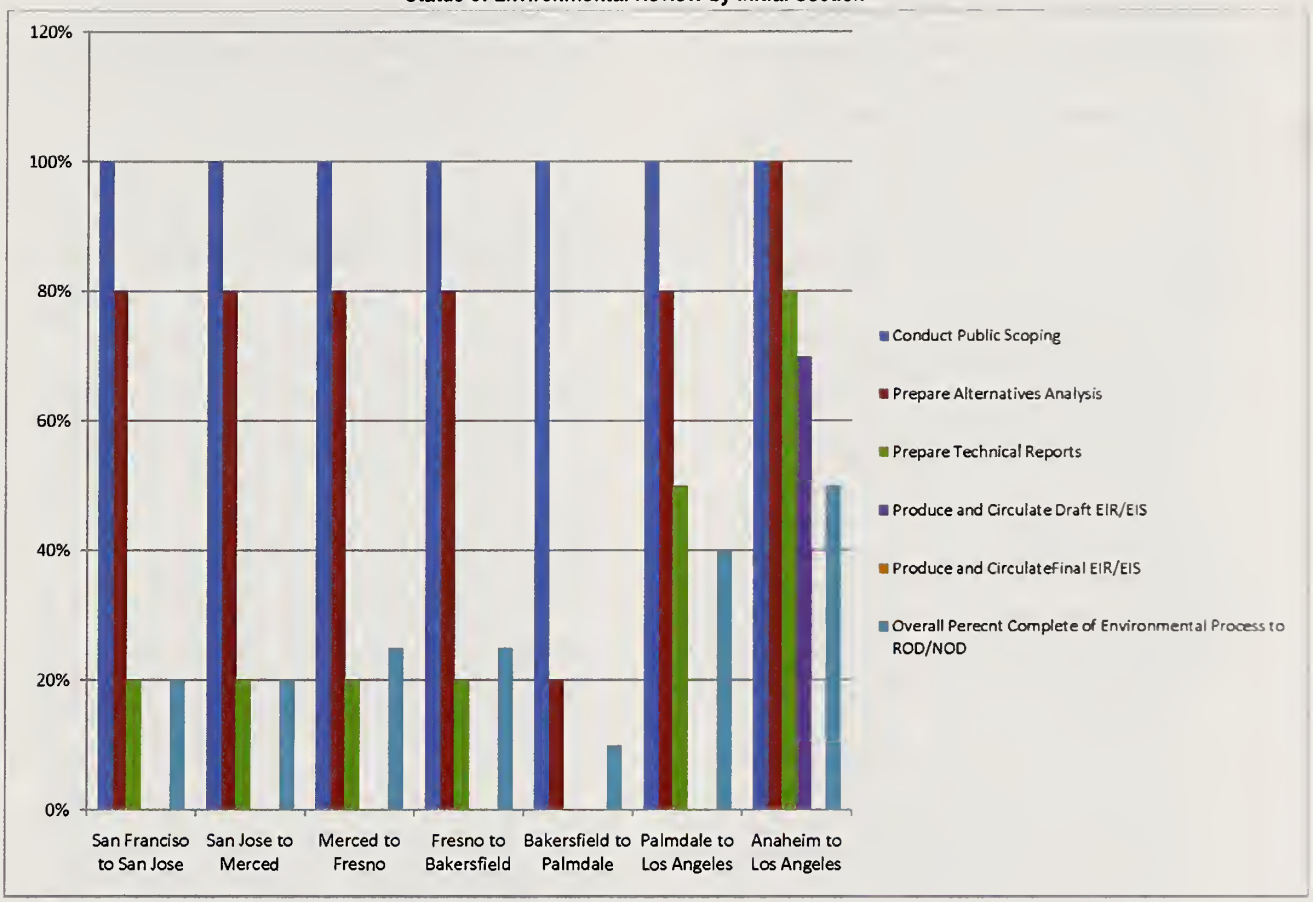


**Exhibit 2:**
**Status of Environmental Review by Initial Section**



## Engineering

The California high-speed train project will use proven technology developed and operated safely throughout the world over the past several decades, which will be brought to the United States through the FRA by way of what is known as a "Rule of Particular Applicability." There are three key considerations that define the technical requirements of the CHSTP. These include:

- A regulatory framework that sets the mandatory safety requirements to ensure public safety of the system, which is further discussed in the Regulatory Approvals section of this document.
- System performance objectives that define what service levels are required of the system, including intercity trip times, which are outlined in legislation (AB 3034, Proposition 1A) included in the California Streets and Highways Code as Chapter 20, Division 3.
- Design standards, and operations and maintenance plans that guide final design, construction, and revenue service operations, which are further expanded in the following sections.

## Design Standards and Operations & Maintenance Plans

Developed to meet the federal and state safety regulations and provide for the performance objectives of the California high-speed train system, project design standards and operations & maintenance plans guide the final design, construction, and revenue service operations of the high-speed rail system.

At the program management level, the engineering efforts are focused on five key areas of activity, all of which are required to confirm that the designed high-speed rail system delivers the performance objectives. These key areas include:

### System-Wide Design Elements

- CHSTP requirements and design for a network-wide 2x25 kV traction power supply system and coordination with the California Public Utilities Commission (CPUC) for approvals process.
- Standard designs for trackwork, overhead contact system (OCS) to ensure a consistent application across the CHSTP network.
- Train control and communications systems specifications that provide Authority requirements for performance, capacity, and safety and for consistent application across the CHSTP network.

### Design Criteria and Standards

- Design criteria that support FRA safety standards and requirements, and the Petition for Rule of Particular Applicability (RPA), including trainsets, track alignment, bridge and viaduct design, tunnel design, building facility structural design, earthworks, drainage design, safety and security, geotechnical investigations and design, seismic considerations, traction power facility equipment, traction power system analysis, overhead contact system configuration, positive train control, system architecture and design requirements, system interfaces, and supervisory control and data acquisition (SCADA).
- Design criteria development is documented in drawings and technical memoranda and includes assessment of existing high-speed rail systems, analysis of what is appropriate for the California high-speed rail system, and design guidance for final design and construction. Design criteria and standards ensure all subsystems deliver a reliable and safe high-speed train system commensurate with industry standards and provide a consistent design approach to be applied to each CHSTP section.

- CHSTP Design Manual is the primary design reference for final design and construction. Standard specifications and special provisions will be developed for inclusion in the procurement documents.

### Maintenance Plan

Program-wide maintenance concept plans for use in defining maintenance facilities, including general locations (but not specific sites), size, and activities of each facility.

Rolling stock inspection and maintenance plan includes activities, and frequency intervals (time or mileage as appropriate) typical for high-speed rail rolling stock for purposes of determining rolling stock facility requirements including types of facilities, activities at each of the facilities including major equipment, required frequency of inspection and maintenance, approximate location for each of the facility types, approximate size of each facility type, and rolling stock sitting time at each location.

Maintenance of track infrastructure, known as maintenance-of-way (MOW), inspection and maintenance activities and frequency intervals (time or mileage as appropriate) typical for high-speed rail infrastructure for purposes of determining MOW facility requirements, including activities at each site, equipment requirements, and approximate size and locations.

### Operational Planning and Concept of Operations

- Operational planning support to confirm programmatic level studies and make regional project recommendations to optimize system performance.
- Operational concepts for the CHSTP, including operational objectives, mainline configuration, control of operations, rolling stock maintenance and repair.
- Operating design criteria including operating routes, operating speed and restrictions, design level of service, operating hours, operating schedule and station dwell times, normal and contingency modes of operations, recovery time, headways, and trainset length and seating requirements.

### Rolling Stock

- Rolling stock specifications to support procurement and acceptance of trainsets that meet Authority performance and safety requirements including maximum operating speed, acceleration rate and braking rates (service and emergency), leading dimensions and clearances, trainset make-up, number of seats, number of trainsets, distributed power versus locomotive hauled, line voltage, radial steering trucks, HVAC requirements, coupling systems (internal and external), carbody materials, energy management systems, signal and train control technologies, and communications requirements.

## Regulatory Approvals

In conjunction with the project-specific environmental reviews and preliminary engineering of each high-speed train section, there are a series of governmental requirements that must be satisfied to implement the CHSTP. These are summarized below, along with the steps being taken to comply.

### U.S. and State Environmental Regulatory Agencies

In order to prepare for the necessary environmental regulatory approvals; the PMT is conducting statewide environmental resource agency coordination meetings. These meetings are held three times a year with the federal and state resource agencies, such as the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, U.S. EPA, CA Department of Fish and Game, State Historic Preservation

Office (SHPO), and others. The PMT role in this coordination is to provide early communication and coordination to ensure that the technical review requirements of the approval agencies will be met in the environmental review process and subsequent applications, in some cases by preparing Memoranda of Agreement or Understanding, or Programmatic Agreements between these agencies and the Authority and FRA. The Authority will continue its meetings and consultations with these agencies as it moves toward seeking necessary approvals.

### U.S. Department of Transportation / FRA

In April 2009, the U.S. Department of Transportation published "A Vision for High-Speed Rail in America" to build a network of high-speed rail corridors across America. Within this document, the U.S. DOT identified the "Need for High-Speed Rail Safety Standards" as one of five challenges inherent in advancing this new passenger rail vision. This Vision document also states that:

> "...the systems approach required to ensure safety of new high-speed rail corridors will necessitate consideration of additional changes in several regulations, including equipment, system safety, and collision and derailment prevention" and that this "opportunity to revise its safety approach in a manner that accelerates the development of high-speed rail while preserving and improving upon a strong safety regime...will be a challenge for the [FRA] as it seeks to administer its critical safety responsibility."

It is important to note that existing federal regulations support train speeds up to 150 mph and that introduction of modern high-speed rail revenue service operations in California and the United States depends on successful completion of a RPA for the CHSTP. The RPA and Notice of Proposed Rule Making (NPRM) is the federal process for introducing and adopting new safety regulations into the Code of Federal Regulations.

With California at the forefront of modern high-speed rail development in the United States, the Authority has taken the opportunity to move forward with the FRA and define how best to implement a system design approach and develop the required federal safety regulations and standards for high-speed rail with operating speeds up to 220 mph. Since September 2008, the Authority and its staff have met with FRA regularly to discuss and advance how the CHSTP will demonstrate compliance with existing federal regulations and, more importantly, how to develop high-speed rail safety regulations to be included in future federal safety regulations.

### California Public Utilities Commission

The California Public Utilities Commission (CPUC) General Order (GO) 95 provides safety-related rules for electrified overhead line construction on transportation systems. As with the federal regulations and high-speed rail at 220 mph, there exists a similar challenge with GO 95 in that it does not address the 2x25kV traction power supply system required for modern high-speed rail. The Authority is meeting with the PUC to determine the best way to proceed in developing the 2x25kV traction power supply system required for high-speed rail operations.

### California Department of Transportation

The CHSTP crosses the state highway right-of-way at dozens of locations including interstates and state routes. The Authority will be working with Caltrans as the owner and maintainer of the state's highway network in areas where proposed HST work would affect the highway right-of-way. To streamline and possibly expedite the review and approval process affecting state highway right of way, the Authority has executed a statewide Master Agreement with Caltrans to provide oversight, environmental document review, design support, and project approval.

## EIR/EIS Management to NOD/ROD

In managing the EIR/EIS process through final approval of a NOD/ROD for each high-speed train section project, guidance has been prepared to ensure that each Regional Consultant will:

- Conduct public scoping meetings with presentation materials intended to inform the public of the CHSTP and have them understand the environmental process.
- Have adequate public, stakeholder, and agency outreach during the environmental process.
- Provide outreach to non-English speaking communities or groups.
- Conduct the AA process with the same level of detail and public/agency involvement needed to select the most reasonable and feasible options, which will avoid or minimize potential impact.
- Use the same study area limits to identify environmental baseline conditions.
- Use the same criteria and significance thresholds to identify potential impacts.
- Identify similar measures to avoid, minimize, and/or mitigate impacts.

During the preparation of the environmental deliverables and EIR/EIS documents by the Regional Consultants, the Authority and PMT staff provide technical and quality assurance/quality control (QA/QC) review to ensure that the guidance and standard methods adopted by the Authority and FRA are followed.

### Preliminary Engineering

The Authority and PMT Engineering staffs are providing ongoing oversight of the Regional Consultants to ensure design consistency across the system and compliance by the Regional Consultants with established design criteria and other requirements. While it is common engineering practice, and necessary, to break out large projects into sections for development, design, and construction, it is critical that all Regional Consultants are guided by a consistent set of design criteria and standards that have been established to ensure the CHSTP will operate as a single system. Design consistency will be achieved by strict adherence to these design criteria by the Regional Consultant teams as they develop their 15 percent Design and 30 percent Design submittals as follows:

> **15 percent Design** – Preliminary engineering to support a regional project EIR/EIS, provide a more detailed construction cost estimate, and conform with all requirements and commitments included in decision documents (FRA ROD; Authority resolution, CEQA findings, and Mitigation Monitoring and Report Plan) and the Final Statewide Programmatic EIR/EIS for the CHSTP, and the Final Program EIR/EIS for the San Francisco Bay Area to Central Valley portion of the high-speed train system. Generally, the level of engineering detail will be sufficient to determine the required footprint for the CHSTP facilities and identify environmental impacts.

> **30 percent Design** – Preliminary engineering to support procurement of final design and construction services, provide a more detailed and accurate construction cost estimate and in conformance with the regional project Final Environmental Documents. Generally, the level of engineering detail will identify all elements of the project to be constructed, but leave construction details and final placement for development during final design.

The engineering-related requirements generally fall into two categories: technical design requirements and safety requirements. Compliance with the technical design requirements is critical in ensuring that the California high-speed train system provides the performance mandated by the guiding legislation (AB 3034) and set forth by the Authority in policy documents. Compliance with the safety requirements, which will be embodied in the RPA for the CHSTP, is critical to securing FRA and CPUC certification to operate the California high-speed train in revenue service.

## Procurement

Procurement activities include development of legal, commercial, and technical elements for bid documents, bid advertisement, bid evaluation, contractor selection, contract award, contract administration, and close-out.

**Legal Provisions for Bid Documents.**

The Authority will have legal and contract support from State resources as well as standard contract language for use in the procurement documents. The PMT will support development of legal provisions specific to the differences between standard state contractual language and procedures with the requirements for alternative project delivery, particularly with respect to liability and indemnification.

**Commercial Provisions for Bid Documents.**

In addition to supporting development of standard commercial provisions, such as progress reporting, and measurement and payment policies, the Authority and PMT staff will review commercial provisions that have been used on other projects to improve construction quality, reduce construction costs, promote worker safety, minimize disruption to the public and stakeholders, and improve project schedules.

**Technical specifications and drawings for Bid Documents.**

The majority of these documents are currently being produced by the PMT and the Regional Consultants. These technical documents include the 30 percent Design submittals, the CHSTP Design Manual, CHSTP Standard Specifications, CHSTP Standard Drawings, and Directive Drawings.

**Bid Evaluation.**

The Authority will manage the bid evaluation process with support from the PMT. An evaluation manual will be prepared and a training seminar will be conducted for the Bid Evaluation Team members. The PMT will provide technical support to the Authority in negotiations with the proposer that the Authority selects to enter into a contract. Project delivery strategies currently under discussion will be further assessed and procurement documents will be prepared and ready for distribution when the regional section NODs/ RODs are approved by the Authority and FRA.

Due to the size of the Program, procurement documents will likely include a range of contract types (e.g., Design/Bid/Build, Design/ Build, Design/Build/Finance, Design/Build/ Operate/Finance, Design/Build/Operate/ Maintain/Finance) depending on the overall delivery strategy and schedule. Regardless, the contracting strategy will reflect the needs of the delivery schedule and operations and maintenance of a safe and reliable high-speed system.

## Construction Management

Following the NODs / RODs and issuance of the procurement documents, projects will move on to the final design and construction stage. At this point, the Authority will procure Regional construction management (CM) contractors, who will manage the final design and construction to ensure compliance with the contract documents. The PMT will focus on oversight and support of the Regional CM contractors, the management of the core systems contractor, and the testing & commissioning program. Core system elements currently include the high-speed trainsets, heavy maintenance facility, train control/ signaling and communications systems, central control center, electrification/traction power systems, and track. The core systems contractor would design, build, demonstrate, test, validate, and verify the core system elements in a test section (at least about 100 miles long) of very-high-speed (250-mph) track in the Central Valley between Merced and , before the high-speed train systems elements are constructed elsewhere in the initial San Francisco to Anaheim route.

Given the number and value of active construction projects and contracts required to

deliver the California high-speed train system, multiple construction management teams will be required to oversee and manage the individual construction projects, similar to the Regional Consultant design teams. The PMT's Construction Manager will monitor and actively manage these Regional CM teams to confirm construction progress, budgets, schedules, quality, and compliance with standards and specifications. This will ensure that a Program-wide perspective is maintained for on-time delivery of revenue service, including development of schedule recovery plans as needed. During this phase, the design and construction contractor will likely bring forward alternative approaches and designs that provide economic benefits to the Authority. A change control process will be implemented to evaluate requested design variations against the published California high-speed train design criteria and standards to confirm any impacts to safety, reliability, and overall achievement of the system performance objectives. Where necessary, the PMT will also provide additional support to the Regional CM teams or take on special assignments to ensure delivery of the construction to meet schedule and revenue service target dates.

It is critical that construction management input be provided at the early stages in the development of the program documents to ensure a high level of efficiency and effectiveness during procurement for design and construction services, as well as during the construction activity itself. Areas where construction management input is critical include review of Regional Consultant 15 percent Design submittal packages for constructability issues and review of Regional Consultant 30 percent Design submittal packages for both constructability and bidability issues.

## Agency Agreements and Permitting

Statewide agency agreements will be prepared with environmental resource agencies to support the environmental permitting required during final design and construction. These agreements, Memorandum of Understanding (MOU), and Memorandum of Agreement (MOA) or Programmatic Agreement (PA), will clearly identify the Authority's responsibilities in meeting the permitting requirements of the federal, state, and regional environmental resource agencies.

The Project's environmental permitting staff will manage the permitting process which begins during the preparation of the Final EIR/EIS. The major environmental permits that each of the HST Projects will require are:

- Section 404 permit under the Clean Water Act
- Section 401 water quality certification permit
- Section 4(f) and Section 6(f) Approvals
- National Pollution Discharge Elimination System (NPDES) Permits
- USF&WS Section 7 Consultation and Biological Opinion
- California ESA permits
- California Department of Fish and Game (DFG) Section 1602 Lake and Streambed Alteration Agreement
- Caltrans Encroachment Permits

## Right-of-Way Preservation and Acquisition

The Authority, with PMT and Regional Consultant support, will lead the right-of-way preservation and acquisition tasks. This work will include identification of "at-risk" parcels, preparation of survey documents and legal descriptions, and preparation for property acquisition negotiations.

**Identification of "at-risk" parcels.** The Authority has the ability to take action to protect rights-of-way and preserve land for the future high-speed rail alignments using the Program EIR/EIS approvals, as available funding permits consensual acquisitions consistent with environmental review requirements. This might be considered in areas where development is

rapidly occurring or where potential changes in land use could significantly increase construction costs.

Survey documents and legal descriptions. As the affected parcels are identified, specific data with respect to ownership, easements, parcel size, and parcel requirements by the CHSTP need to be gathered and documented as a legal description to support negotiations.

Negotiation. Specific land acquisition by segment can begin upon issuance of the regional project NOD and ROD. Right-of-way acquisitions will conform to the state and federal relocation assistance requirements, and other state and federal provisions required at the time of acquisition. As part of the right-of-way process, and where shared use with existing railroad corridors is confirmed, the Authority will negotiate terms of access for shared rights-of-way with railroad owners and operators.

## Program Implementation

Implementing initial revenue service by 2020 will require setting many wheels in motion in 2010. This section outlines a series of pre-construction activities, commencing within the next year, essential to achieving that goal. The project's near-term focus must be to advance and complete the required environmental reviews and preliminary engineering for each of the seven CHSTP initial sections between San Francisco and Anaheim. In parallel with producing these environmental review and preliminary engineering documents, the Authority must also commence a series of activities in preparation for the start of construction as outlined below.

## Pre-Construction Activities

One of the first steps in planning for the design and construction of the initial system is to develop and maintain a Project Master Schedule, detailing the myriad of activities required to implement the CHSTP. The master schedule will include established milestones for the NOD and ROD for each section and planned design/construction/testing/commissioning/start-up activities in each geographic section and project-wide. The master schedule will be based on a series of supporting plans, including:

- ROW acquisition and relocation plans, section-by-section
- Contract packaging plan section-by-section and system-wide
- Procurement plan, including early work, core systems, Design / Build (D/B) infrastructure and system-wide construction contracts, and system operator
- Testing & Commissioning plan, and
- Revenue Service Start-up plan

The work plan must take into account the schedule requirements and milestones established by the FRA for ARRA Track 2 grant funded projects.

The master schedule will identify early construction work – utility relocation, ROW clearing, railroad track relocation, building demolition, major grade separations, and other "early work" to reduce construction risks. The vast majority of the heavy construction work will be procured and delivered through large D/B contracts, but early work will be contracted using the best available means, including traditional design-bid-build and railroad force account, as appropriate, as well as through smaller D/B contracts. In each case, a financial package from the private sector will be part of the contract approach.

Another key near-term activity is procurement of the system operator. There are a number of options for how the operations and maintenance (O&M) contract could be structured. It could be packaged with the core systems procurement or separately as a long-term (multi-year) concession. The exact timing and structure of this procurement has not been decided yet; however, an initial Request for Expression of Interest (RFEI) for the system operations and maintenance contractor, along with RFEIs for the major civil infrastructure, core systems/trainset contractors, and financing,

was issued in 2008. Since then, the Authority has continued to reach out to the private sector to gauge interest in the project as well as seek guidance on technical and procurement issues. In the future, draft contract documents will be sent for industry review to selected respondents, and the industry feedback will be used in preparing the final Requests for Proposals and contract documents for the major contract procurements to follow.

In 2010, the Authority will develop draft RFPs for industry review of the core systems. The proposed approach involves contracting with a consortium – a single contract team – to design, build, demonstrate, test, validate, and verify the core system elements in a test section (at least about 100 miles long) of very-high-speed (250-mph) track in the Central Valley between Merced and Bakersfield, before the high-speed train systems' elements are constructed elsewhere in the initial route. The roles and responsibilities of the O&M and core systems contractors are fundamental to achieving a safe, reliable, maintainable and profitable high-speed rail service.

Prior to the possible hiring of a core systems consortium, individual sections of the Phase 1 HST final design and infrastructure construction will commence as environmental reviews are completed, and as funding is available, very likely starting with the ARRA-funded program corridors. Applications for ARRA-funded corridor design and construction programs were submitted for the San Francisco-San Jose, Merced-Fresno, Fresno-Bakersfield, and LA-Anaheim sections. The funding levels and timing of the ARRA-program work will affect how soon construction can start and which sections are built first. Various scenarios can be envisioned for implementing pieces of the system, and connecting them into operable segments. The scenario ultimately adopted will depend in part on the outcome of the ARRA Track 2 grant requests and negotiations, and which sections will have near-term committed funding by the High-Speed Rail Authority Board.

The infrastructure contractors may install the track and electrification systems outside of the test track area; the core systems contractor will install all other systems elements project-wide. As part of the core systems contract, the heavy maintenance facility (HMF), to be built adjacent to the high-speed test track, will be needed in time to receive trainsets for final assembly, testing and commissioning. The HMF likely will house the central control center for the entire system.

Depending on the ARRA grant determination, infrastructure in the LA-Anaheim, Merced-Bakersfield, and San Francisco–San Jose sections of the route might be constructed first, followed by the San Jose to Merced, Bakersfield to Palmdale and Palmdale to LA sections.
Other pre-construction activities include:

- Developing draft construction RFP documents and construction contract documents: General Provisions, Special Provisions, Standard and Directive Drawings and Standard Specifications
- Identifying Construction Management (CM) requirements and preparing RFPs for procuring Regional CM consultants
- Commencing ROW acquisition, particularly "protective" acquisitions
- Obtaining all necessary environmental permits
- Applying for FRA and CPUC safety waivers and approvals, including the FRA "Rule of Particular Applicability" for the CHSTP

## Construction Staging

Upon receiving environmental approvals and finalizing funding agreements, the Authority will issue construction RFPs, continue ROW acquisition, and procure CM services. Early work will commence while the major D/B contracts are being advertised and awarded. Early work will include site clearing and grubbing, railroad track and facilities relocation, building demolition, environmental remediation work, and utility relocation in coordination with the major D/B contract schedules. The Contract Procurement Plan will be updated as the timing of additional environmental approvals and

funding sources becomes known. The Project Master Schedule will be updated monthly to incorporate contractors' approved CPM schedules and monthly updates. The general sequence of construction is envisioned to be as follows:

- Advertise, bid and award ARRA-funded design and construction
- Advertise, bid and award other early work, section-by-section
- Advertise, bid and award core systems in the Merced to Bakersfield section
- As environmental approvals are received and funding is available, advertise, bid and award other major D/B infrastructure contracts
- Develop and implement integrated systems testing, verification and validation of the core systems design
- Complete the test track, HMF, central control and other core systems elements
- Receive trainsets, continue integrated testing, "burn-in" and vehicle acceptance
- Incorporate and integrate the test track verification and validation results with the line section track, electrification and regional "systems" elements and with the system-wide systems contracts (train control/signaling and communications, SCADA, and central control contracts)
- Administer early work and D/B contracts, including field changes, change orders, claims management, and contract close-outs
- As facilities are completed, the Authority will commission stations, facilities, and systems to achieve operational readiness in conjunction with the integrated testing of each section
- The Authority will obtain CPUC and FRA safety approval prior to commencing revenue service in Minimum Operable Segments, which will be further defined as the Project Master Schedule is further developed
- Once the operable segments are connected and sufficient high-speed trainsets have been accepted, and system-wide testing, commissioning and training are completed, full Initial revenue service can commence

## Independent Utility

Infrastructure in the LA-Anaheim, Merced-Bakersfield, and San Francisco–San Jose sections as proposed in the federal grant applications would have independent utility even if the entire CHSTP were not completed.

The LA-Anaheim corridor program will fully grade-separate the existing right of way, expand the width of the right-of-way where needed, construct the alignment and track needed for separate 110 mph operation to standards that would allow the operation of the high-speed train and lightweight DMU equipment, and improve stations at Anaheim and Los Angeles. The grade separation of this busy line, with projected 60 freight trains, 22 intercity Amtrak Surfliner trains, and 32 Metrolink trains daily, will greatly enhance crossing safety for rail and road users, decrease the causes for delays, and allow faster operations schedules.

In the Central Valley, the Authority is proposing to build the rural sections of high-speed track between Fresno and Bakersfield and between Merced and Fresno in a way that would provide independent utility to Amtrak's San Joaquin service between those cities, if for whatever reason the rest of the High-Speed Rail system were not completed at the same time. The grade separations would greatly enhance crossing safety for both passenger and freight trains in the corridor, and the new high-speed trackage would be configured so that it could be connected to the existing Amtrak stations in Merced, Fresno and Bakersfield, if the system were not completed at the same time.

In the San Francisco – San Jose corridor, the Project would help implement long-standing plans to electrify the corridor, and to grade-separate several high-priority road rail crossings in order to prepare the ground for high-speed train service, and allow Caltrain to operate more reliably and quickly. As in the other projects

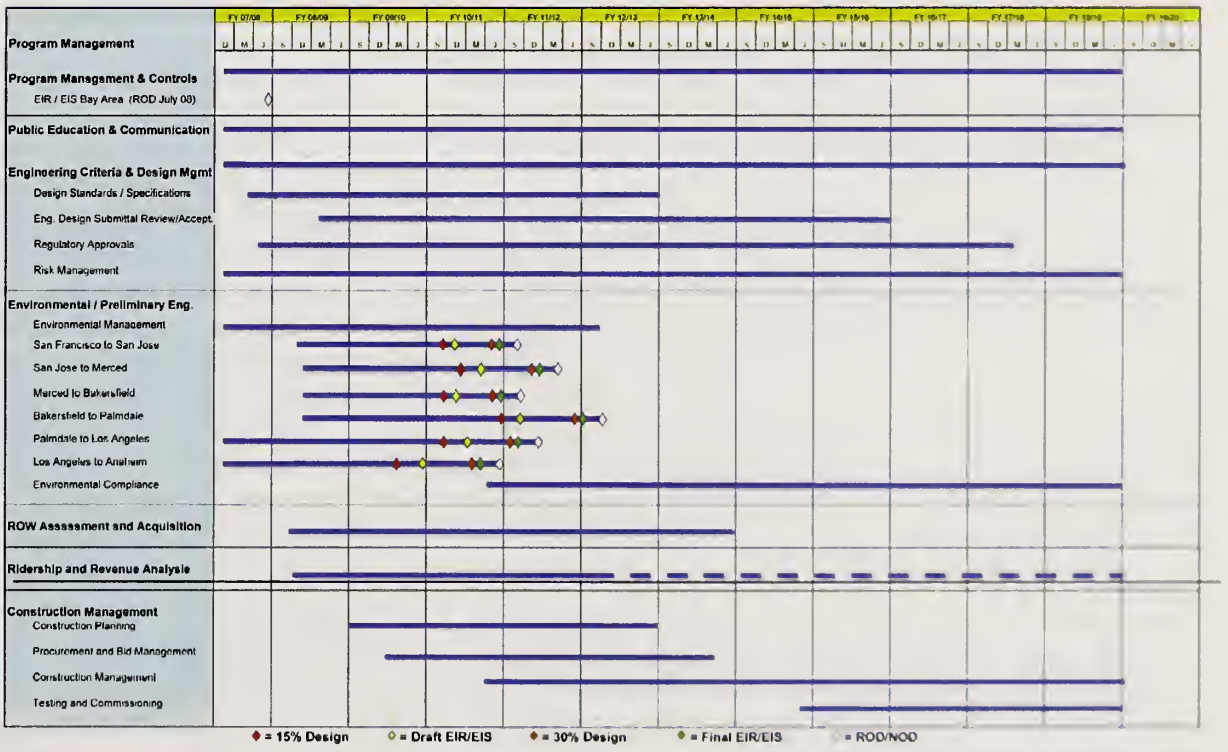
above, the grade separations would greatly enhance crossing safety for rail and road users. Moreover, the speed-up that Caltrain estimates is possible as a result of these improvements would enhance the attractiveness of the Capitol Corridor trains and the Starlight, which use the San Jose Diridon station, as well as save time for those in the northern part of the Peninsula who access the Amtrak Capitol Corridor trains at Emeryville via Caltrain and the dedicated bus link from the Caltrain 4th & King Street station.[17]

Funding permitting, all sections of the route could be under construction by the 2012–2014 timeframe. As individual sections are completed and tested they could be operated as "minimum operable segments." For instance, once the San Jose-Merced section is completed, it could be connected to the Merced-Bakersfield section and initial service could commence between San Jose and Bakersfield. Likewise, once the line is built and tested through the Tehachapi Mountains, initial service could be extended to Palmdale. Incremental construction and connection of operable segments would continue until the entire San Francisco-to-Anaheim system is fully operational.

## Schedule

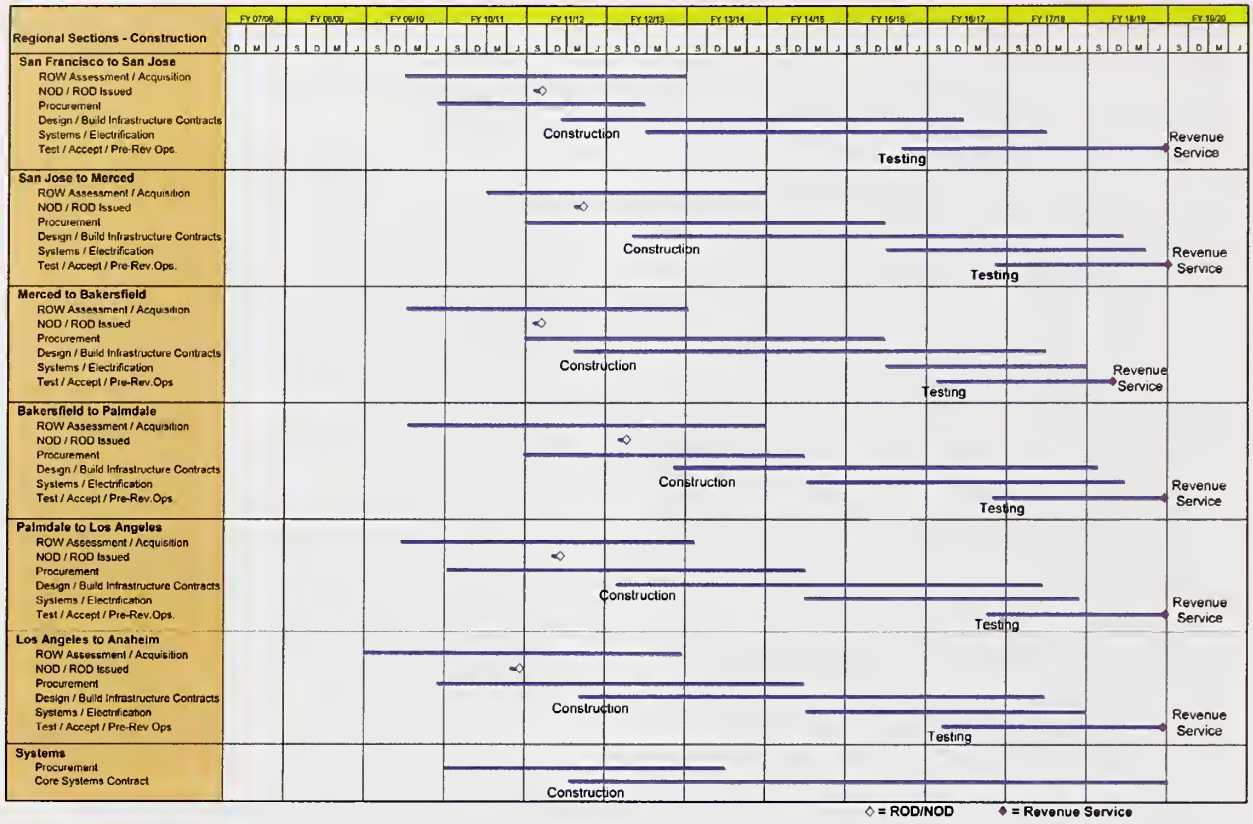
The following Master Summary Schedule for the San Francisco to Anaheim portion of the CHSTP is split in two parts: program management activities and right-of-way acquisition and construction activities. Together they show major program management activities and currently projected timelines for the regional project-level environmental review/ preliminary engineering, target NOD/ROD milestones, procurement activities, final design/ construction durations, testing/acceptance, and pre-revenue operations leading to the start of initial revenue service in 2020. This schedule will be updated as the project advances and as funding is secured to support the final design/ construction of the Project.

**SAN FRANCISCO–ANAHEIM MASTER SUMMARY SCHEDULE** – Program Management Activities




17 See discussion of court order at p. 7.

## SAN FRANCISCO–ANAHEIM MASTER SUMMARY SCHEDULE – ROW and Construction Activities



# Outreach

## California High-Speed Rail Authority's Outreach Program

Effective outreach is integral to achieving the goals of the high-speed train project, and in its mission to be transparent and accountable to the people of California it is incumbent upon the Authority to effectively engage the public.

Events over the past 13 months have necessitated that the Authority's outreach efforts turn from educating Californians about high-speed rail's opportunities to a new level of informational outreach that engages and empowers the broader public as they become stakeholders in a project that is moving toward construction. With the higher visibility that will accompany construction start-up – potentially as early as 2011 – the Authority's responsibility to keep Californians fully informed becomes even more demanding.

Moving forward, the Authority plans to increase the amount, and improve the quality of outreach efforts – to reach more Californians with more information – through refocusing its regional outreach teams and upgrading outreach tools such as Web-based interactive tools, outreach to ethnic communities, and partnerships with legislators and local government agencies.

Between today and the commencement of construction, there will be ample and significant opportunities for public input and interaction. These opportunities are detailed in the following section.

Outreach to government agencies, stakeholders, the news media and the public has been and continues to be a significant obligation and mission of the California High-Speed Rail Authority. Statewide and section-level outreach efforts communicating plans and benchmarks for the project ensure transparency, provide a platform for local stakeholder input, and help build strategic partnership alliances that will result in collaborative operation of the system.

### Outreach Efforts to Date

To date, the California high-speed train project's outreach and public information efforts have been coordinated primarily by subcontractors[18]– at the statewide level by a subcontractor (Deutschman Communications Group) directed and managed by the Parsons Brinckerhoff Program Management Team (PMT), and on a regional level by subcontractors to each of the Regional Project Management teams.

Outreach has been focused on broad public project awareness and on the outreach and public engagement required within state and federal environmental review processes.

Through the environmental review process, outreach has relied heavily on the project's regional-focused engineers and environmental planners, who have interacted with regional transportation agencies, cities, counties, legislative staff, and the public through public meetings and written materials.

### Moving Forward

Events over the past 13 months necessitate increased outreach efforts. Those events include:

- Passage of Proposition 1A
- Inclusion of high-speed rail funding within the American Recovery and Reinvestment Act
- Increased interest and demand for information from California residents, local governments, legislators, and the media
- Significant project planning milestones including public scoping meetings and entering the alternatives analysis process within several project sections

18 Detailed below within discussions of each regional section

Recognizing the need for increased outreach efforts, the Authority in August 2009 created the position of Deputy Director for Communications, Policy and Public Outreach, and Governor Schwarzenegger appointed a person to fill that role. The goal of creating the position was to bring outreach activities under the direct control of the Authority, to streamline the outreach program, and to increase the quantity and quality of outreach activities. To that end, the Authority also initiated the procurement process to bring aboard a new Statewide Communications and Outreach contractor. Ogilvy Public Relations Worldwide was chosen in November as that new contractor, and is expected to begin work with the Authority in January 2010, following the approval by the Department of General Services of a contract.

### Overall Communications Strategy

It is the Authority's goal to reach as many stakeholders and interested parties as possible with thorough, accurate information about the planned high-speed rail system and its progress. Those stakeholders and interested parties range from California residents and community groups to elected officials, the financial industry, international governments, and private businesses.

The Authority's outreach efforts occur on dual but complementary tracks. The first is the public engagement required as vital steps within the environmental review and planning process. This occurs on a section-by-section local level. The second track is general public awareness of the project, managed at the statewide level.

To achieve its outreach goals, the Authority employs a number of tools, outlined below.

### Public Engagement

The Authority's outreach program is responsible for engaging and responding to the public. It accomplishes that by directly dealing with the public in public meetings, through written correspondence, person-to-person interaction, and other modes of communication. It also engages the public through partnering with regional transportation agencies, through local governments, through legislators, and through the news media.

Moving forward, the Authority and its new streamlined outreach organization plan to increase the amount and quality of public engagement by refocusing regional management outreach staff and by improving its Web-based public interaction tools.

### News Media Relations

The Authority must rely on the news media as a primary source of communication to the public, since it does not currently employ advertising or other costly mass-marketing options. The outreach team writes and distributes all press releases and media advisories, prepares and places articles in state and national publications, responds to requests for information from journalists, and schedules media interviews with appropriate representatives. In addition, the team writes or prepares all communication instruments for the Board and project, including regional outreach materials and press relations for Authority Board meetings and activities.

Guided by the deputy director for communications and public outreach, outreach team and PMT members handle virtually all international, national, statewide and regional media relations for the Authority, responding to nearly 1,000 media inquiries in the past year alone. This work has generated significant coverage of California's high-speed train system in recent months, including coverage by CBS Sunday Morning, PBS Television, National Public Radio, the New York Times Sunday Magazine, Wired Magazine and dozens of other national, state and local print and broadcast media.

Because of the changing nature of the news media, the outreach program makes significant efforts to reach public and news media audiences through Web-based communications vehicles.

In recent months, due to interest in available ARRA stimulus funding and to progress in the California high-speed rail project's development, interest from media outlets has increased and will bring more awareness to the project.

### Web Site Strategy and Content Management

The Authority's Web site is a vital tool for providing project information and details to interested parties and for providing another means of contacting the Authority. The Web site houses all documents developed by and for the Authority – from reports and studies to Board meeting agendas, project details, environmental documents, etc.

The Authority is currently reviewing, updating and reprogramming its Web site, focusing on making the site more user-friendly. A key goal is to regionalize available information to provide better project understanding for local stakeholders. Responsibilities include regular updates to the Web site and posting of new information such as EIR/EIS materials, Board meeting documents, program media statements, press releases, and more. The site now includes Webcast capabilities for Board meetings, providing stakeholders an easier way to participate and obtain information.

Additionally, the Authority has begun to employ social media tools to provide information and a means of interaction where today's Internet-users are congregating.

### National and International Stakeholder Presentations

The Authority receives dozens of requests every year from national and international leaders and organizations to provide information and presentations about the status and details of California's high-speed train. Recent presentations were prepared for U.S. Secretary of Transportation Ray LaHood; the Federal Railroad Administration; dozens of business, transportation and environmental groups throughout the state; and national and international conferences, such as the American Public Transit Association and the Cordoba Conference on high-speed train development in Spain.

The Authority already has experienced a significant increase in demand from national and international sources for information and contact – an important element of the outreach program because of the interconnectivity of high-speed train planning, design and production resources and programs around the world.

### Presentation and Printed Materials

Important to any statewide project of this scope are printed materials that help communicate key project details. The outreach program prepares such materials as:

- Statewide and region-specific brochures and fact sheets.
- PowerPoint presentations for CHSRA speakers.
- E-Newsletters and Alerts, sent to the CHSRA stakeholder databases of thousands of individuals.

The Authority has created visual simulations over the past several years to help the public and stakeholders better understand the proposed system – what it will look like, where it will go, how it will interconnect with regional transportation networks and how it will affect local communities. Those simulations play a valuable role in establishing understanding and context for environmental analysis, local planning and partnership development.

Moving forward, the Authority will focus its printed and other materials at a regionalized and intensely local level, to provide Californians information about the train project in very intimate terms of how its development construction, and ultimate service will affect their communities and daily lives.

### Ethnic and Diverse Communities Outreach

Statewide and regional outreach efforts have always included significant steps to engage, inform and take input from California's diverse communities. Multilingual printed materials and legal advertising have been a compulsory part of the Authority's outreach. Staff and contractors regularly interact with ethnic and diverse audiences and stakeholders. Moving forward, as the demands of public outreach increase, the Authority intends to add a specific ethnic outreach component to the statewide communication plan and team, as a member of the Ogilvy team being brought on board. That person will advise the Authority on ethic outreach strategies and lead the effort to implement them.

### Partner Agencies

The Authority will increasingly rely on partner agencies with established contacts and interaction with their communities to assist the Authority on spreading information about the high-speed rail project. Those agencies include regional transportation agencies such as the Orange County Transportation Authority and SamTrans. Through its newly appointed deputy director for communications and public outreach, the Authority is beginning to more directly engage those partner agencies with its outreach efforts, in addition to its planning efforts.

### Legislative Outreach

Partnering with members of the Legislature and their staffs is a critical piece of reaching Californians with information about the high-speed train project and also of hearing their voices. Legislators have their fingers on the pulse of their communities, and are an established viaduct of communication from local communities into the state capital. The Authority, led by its newly elected Board Chairman, is taking steps to better inform legislators of the train project's progress and more effectively engage legislators and their staffs in the public outreach process.

### Communications Protocols

The outreach team regularly updates detailed communications protocols to standardize outreach among and within sections, which ensures consistent communication formats, styles and language. Similar protocols have been developed for the CHSRA board of directors and other project partners to ensure consistent and accurate information is distributed to the public and to create a framework for more efficient interagency activities.

Additionally, the Authority's program management team has committed to training its regional managers in Context Sensitive Solutions, an outreach tool being employed with the communities in the Bay Area's Peninsula that is a collaborative, interdisciplinary approach that ensures input from all stakeholders. By ensuring that the high-speed rail project's regional managers are trained in this collaborative public engagement mindset, the Authority believes outreach efforts will improve in quality.

### Regional Outreach Efforts

As it had done for the public unveiling of the Program-Level EIR/EIS for the majority of the high-speed train line, the outreach program continues to manage the development and implementation of a communications strategy to support the public release of the project-level documents for the planned system.

Under direction of the deputy director for communications and public outreach, the statewide outreach team closely collaborates with the PMT and nine section teams to develop and carry out section-specific public outreach programs in key areas around the state to inform stakeholders and the media about public hearings, board meetings and other relevant issues related to the project. The Authority manages the review and approval process for all regional public-education and project-level EIR/EIS material.

## OPPORTUNITIES FOR PUBLIC INPUT / ENGAGEMENT / OUTREACH

The Authority's responsibility for outreach associated with project-level environmental review requires use of a comprehensive set of tools to ensure all parties are heard and opinions considered, both to comply with state and federal law and to meet the Authority's goal of transparency. Those tools include:

- Establishment of a single point of contact to ensure access and openness
- Briefings/meetings with existing community and civic organizations (i.e., business groups, service clubs, neighborhood associations, etc.)
- Organized and highly publicized community-wide meetings
- Regular updates for local elected officials, both one-on-one and at regularly scheduled public meetings
- Outreach to key local agency management, planning and engineering staff
- Direct mail/print ads where necessary to communicate project information and to meet CEQA legal requirements
- Cooperative outreach and communications with local jurisdictions (i.e., utility bill inserts, newsletters, etc.)
- Communication support for high-speed train Technical Working Groups
- Design workshops (to be held in cities identified for potential future HSR stations)
- Electronic access to information (i.e., Web site, e newsletter, on-line town hall, etc.)
- Specialized translations of communications materials into multiple languages
- News media outreach (alerts, editorial board presentations, news releases, etc.)
- Cable TV access to information and events

### Local Outreach Activities

The Authority provides oversight for all local outreach, including public affairs consultation with local government agencies and elected leaders, outreach to local community organizations, news media relations and coordination of activities with the Authority staff when Board activities touch their regions.

Working with the PMT, regional outreach team members monitor and participate in CHSRA's regional Technical Working Group meetings to assist local engineering and environmental teams on the high-speed train project. Below is a summary of public outreach activities, organized by broader region.

Following is a description of the regional outreach teams and lists of groups, entities, and individuals they have interacted with regarding the project to date.

### Bay Area Outreach

**Responsible Outreach Contractors:**

CirclePoint, EDAW-AECOM, Garvey Communications

This region includes the preferred Pacheco Pass route through Gilroy to San Jose and the San Jose-to-San Francisco section. Outreach activities in the sections within this region have focused on city-specific strategies appropriate to a proposed high-speed train line that crosses so many different communities. This region has experienced a high concentration of attention from diverse groups with acute sensitivities to the design of the system – from individual cities to environmental organizations to regional transportation agencies.

## CONTEXT SENSITIVE SOLUTIONS (CSS)

In the Bay Area's Peninsula, the Authority, the project management team and its regional management team have pursued a structured decision-making approach to better fit the high-speed train to the local communities it serves. Known as Context Sensitive Solutions, and offered as a tool by members of the local community, it is a collaborative, interdisciplinary approach that ensures input from all stakeholders. It is an approach that helps preserve and enhance scenic, aesthetic, historic, community, and environmental resources, while improving or maintaining safety, mobility, and infrastructure conditions.

In cooperation with the PMT, the local outreach team has coordinated and prepared documents and presentations for scores of meetings related to the project and will continue to do so until the start of construction and eventual revenue operation. In the past year alone, the team has coordinated outreach to nearly 100 individual organizations, chambers of commerce, public agencies and stakeholder groups. Groups and events over the past year have included but are not limited to (in alphabetical order):

- ACE
- Alameda CMA
- Altamont Working Group
- Assemblymembers: Ruskin, Hill, Ma, Yee, Ammiano and Leno
- Audubon Society
- BART and BART Board of Directors
- Bay Area Council
- Breathe California Clean Air Awards
- CalTrain
- CalTrans – District 4
- CalTrans – Cal Mentor Program
- Capitol Corridor
- Chambers of Commerce of: Berkeley, Mountain View, Concord, San Mateo, San Francisco (Global Warming Summit), Palo Alto and Menlo Park
- Cities of: San Francisco, San Jose, Millbrae, Atherton, Redwood, Menlo Park, South San Francisco, San Bruno, Brisbane, Santa Clara, Palo Alto, Sunnyvale, Fremont, Morgan Hill, Gilroy, Los Banos and Chowchilla
- City Councils of: Menlo Park, San Bruno, Burlingame, Mountain View, Sunnyvale, Millbrae, South San Francisco and San Francisco
- Committee for Green Foothills
- Community Club of Rossmoor
- Downtown San Mateo Association
- East Bay Engineers Club
- Grasslands Water District
- Greater Gardner Community Association
- Green Career Fair
- Greenbelt Alliance
- Lake Merritt Breakfast Club
- Latino Issues Forum
- Monterey County
- Nature Conservancy
- North Willow Glen Neighborhood Association
- Palo Alto – Southgate Community Meeting
- Palo Alto Transportation Department
- Peninsula Cities Coalition
- Railway Industrial Clearance Association
- SAMCEDA
- San Bruno Leadership
- San Delmas Park Neighborhood
- San Francisco Building and Construction Trades Council
- San Francisco Labor Council

- San Francisco Transportation Authority
- San Joaquin Council of Governments
- San Joaquin Partnership Meeting
- San Jose Chamber of Commerce/ Downtown Association/Convention & Visitors Bureau
- San Mateo Building Trades Council
- San Mateo Transportation Authority
- Santa Clara Valley Transportation Authority
- Sierra Club, Loma Prieta Chapter
- Silicon Valley Land Trust
- Silicon Valley Leadership Group
- Silicon Valley Projections Conference
- SPUR
- Stanislaus COG
- Sustainable San Mateo
- TALC and ACEC-CELSOC
- Transbay Groundbreaking
- Transit Camp Regional Planning Conference
- Tri-Valley Policy Advisory Committee
- WTS – East Bay Construction Specification Institute

Within the past year, the outreach program also has assisted in building alliances with numerous regional and national organizations and government leaders, including:

- Speaker of the House Nancy Pelosi
- San Francisco Mayor Gavin Newsom
- San Francisco Board of Supervisors' President Aaron Peskin
- San Jose Mayor Chuck Reed
- Rep. Jackie Speier
- Rep. Anna Eshoo
- San Francisco Chamber of Commerce
- State Senator Carol Migden
- Silicon Valley Leadership Group
- Valley Transportation Authority
- Capitol Corridor
- Sierra Club

## Central California Outreach

**Responsible Outreach Contractors**:

The Forhan Company, Endicott Communications, Gene Tackett Consulting Services, URS

This region encompasses a broad swath of the state, with widely separated communities each with widely divergent character and need. Some of the earliest and most important elements of the system – the test track and heavy maintenance facilities – will be located in this region.

Outreach in this region has included a wide variety of groups and events, including but not limited to (in alphabetical order):

- Altamont Working Group – regular participant
- American Public Works Association, Central Valley Chapter
- Antelope Valley Board of Trade
- Association for Commuter Transportation (Sacramento)
- Bakersfield Breakfast Rotary Club
- Bakersfield Mayor Harvey Hall and his staff
- Breathe California (Sacramento)
- California Partnership for the San Joaquin Valley – attend quarterly board meetings
- CalTrans Corridor Project
- Central California Hispanic Chamber of Commerce (Fresno)
- Chambers of Commerce of: Stockton, Manteca, Lodi, greater Merced, Sacramento Metro, Atwater, Elk Grove, Turlock, Galt, Taft, Tracy, Orange Grove, Auburn, Ripon, Rancho Cordova, Greater Stockton, Fresno (Transportation Committee) and Bakersfield
- Chowchilla Lions Club
- Chowchilla Rotary Club
- Cities of: (provided presentations or study sessions to) Hanford, Visalia, Corcoran, Wasco, Shafter, Tulare, Fresno, Madera and Merced
- Counties: provided presentations to Board of Supervisors in Fresno, Kings, Tulare (individual meetings), Madera and Merced
- Clean Air Partnership
- Clovis Rotary Club
- Downtown Sacramento Partnership
- Downtown Stockton Alliance
- Folsom Transportation Panel Discussion
- Fresno Council of Governments
- Fresno Downtown Station Planning Meeting
- Fresno Economic Development Corporation
- Fresno Mayor Ashley Swearengin (elected Nov. 2008) and Former Fresno Mayor Alan Autry (through December 2008)
- Fresno Revitalization Corp. Board of Directors
- Fresno Technical Assessment Group (consisting of city, county and COG staff)
- Great Valley Center (Modesto) – assisted in Authority's role as major sponsor of annual conference in Sacramento – April 2009 – staffed Authority booth and arrangements for panel session on HST project
- Hanford Kiwanis Club
- HST Consolidation TAG Meeting
- Highway 50 TMA
- Kaiser Commuter Group
- Kern County Resource Management Team
- Kings County Board
- Leadership Fresno
- Legislators (State): Assembly Republican Leader Mike Villines, Senate Republican Leader David Cogdill, Ashburn, Denham (Chief of Staff), Perata (Staffer) and George Runner
- Madera City Councilmembers: Robert Poythress, Gary Svanda and Mayor Sam Armentrout

- Madera County Supervisors: Bigelow, Rodriguez, Moss and Wheeler
- Madera County Transportation Commission
- Modesto Rotary Club
- Modesto Sons in Retirement
- Oildale Rotary Club
- Placer County Transportation Planning Agency
- Point West Area Transportation Management Agency
- Port of West Sacramento
- Porterville Lions Club
- Rancho Cordova Economic Development Department
- Reedley Kiwanis Club
- Sacramento Air Quality Management District
- Sacramento Area Council of Governments (SACOG)
- Sacramento Area Trade and Commerce Organization (SACTO)
- Sacramento Chamber of Commerce's Perspectives 2008 Event (attended by more than 1,000 leaders)
- Sacramento Convention and Visitors Bureau
- Sacramento Mayor Kevin Johnson and his staff
- Sacramento Metropolitan Air Quality Management District
- Sacramento Rotary Club
- Sacramento Transportation Authority
- San Joaquin Council of Governments
- San Joaquin County Partnership
- San Joaquin Valley Regional Policy Council – COG Directors for the Central Valley Counties
- Senator Darrell Steinberg's Office
- Sierra Oakhurst Kiwanis Club
- South Natomas TMA
- Stockton Alliance
- University of the Pacific (UOP)
- Valley Vision
- Yolo County Supervisors: Thompson and Rexroad
- Yolo Transportation District

## Southern California Outreach

**Responsible Outreach Contractors :**

VMA Communications, Arellano Associates, Consensus Inc., Katz and Associates

Outreach activities in the sections within this region are perhaps the most complex on the system. The team must meet the needs of early development of the system in an area with an existing but still-developing regional commuter rail system, multiple well-established regional transportation planning agencies and a diverse timetable for construction of several intercity sections on the system. Additional ongoing responsibilities attend the need to help negotiate sensitivities around use of historic Union Station and development of a new hub transportation terminal in Anaheim.

As in other regions, the Southern California outreach team has worked closely with the PMT and regional management teams, regularly coordinating meetings, presentations, materials and personal contacts with scores of groups and events, including but not limited to (in alphabetical order):

- Access Los Angeles
- Alhambra Rotary Club
- American Planning Association – California Chapter
- Anaheim Green Expo
- Anaheim State of the City
- Anaheim Transportation Network Board
- Assemblymembers: Silva, Solario, Tran and Eng
- Beverly Hills Realtors Association
- Brookhurst Community Center
- Buena Park Senior Center Meeting
- Burbank Rotary Club
- CalTrans – District 11
- Chambers of Commerce of: Universal City, North Hollywood, Burbank, Quartz Hill, Montebello, Anaheim, OCBC, Los Angeles, Southeast Regional, City of Commerce Industrial Council, San Diego, San Fernando, VICA, Bell Gardens, Ontario and Riverside
- Cities of: Bell, Palmdale, Escondido, Tustin, Buena Park, Pomona, Temecula, Murrieta, San Bernardino, Rancho Cucamonga, Anaheim, Santa Clarita, Upland, Claremont, San Fernando, Burbank, Glendale, Orange, Montebello, Commerce, Pico Rivera and Los Angeles – more than 140 cities were briefed
- CMAA Owner's Night
- County of San Bernardino
- Culver City Music Festival (July and August 2008)
- Design Workshops conducted or participated in: Los Angeles, Norwalk, Vernon, Fullerton, Santa Fe Springs, La Mirada, Bell, Buena Park and El Monte
- Downey Kiwanis Club
- Downtown Los Angeles Neighborhood Council
- Earth Day Market Festival
- Electric Vehicle Association
- Fullerton Municipal Airport Noise & Safety Committee
- Fullerton Sunrise Rotary Club
- Gateway Cities Council of Governments
- Green LA Transportation Working Group
- Hollywood Community Police Advisory Board
- I-710 Technical Advisory Committee
- Knott's Berry Farm
- LA-32 Neighborhood Council Meetings
- La Mirada Rotary Club
- Laguna Canyon Conservancy

- Lincoln Heights Neighborhood Council
- Little Tokyo Community Council
- Los Angeles City Council & LA City Council Ad Hoc Committee
- Los Angeles City – District 9 Planning Team
- Los Angeles Councilmembers
- Los Angeles County Metropolitan Transit Authority (MTA)
- Los Angeles Mayor's Transportation Staff
- Los Angeles Parks & Recreation
- Los Angeles Regional Team Meeting
- Los Angeles County Supervisors
- Los Angeles Technical Group
- LOSSAN Board
- Los Amigos
- LULAC
- METROLINK
- Metro Gold Line Construction Authority
- Palmdale/Antelope Valley Chamber of Commerce
- Montebello Concert Series
- Mobility 21
- MOU Partnering Agencies for the SD-LA Section – SANDAG, SANBAG, SCAG, RCTC and SDRAA
- North Hills West NBHD Council
- Northridge West Neighborhood Council
- NRDC
- Ontario APA – Rebuilding America
- Point Loma Town Hall Meeting
- RailPAC
- Rio Honda Rotary Club of Bell Gardens
- Riverside County Transportation Commission
- Riverside County Supervisor Bob Buster
- San Bernardino Association of Governments
- SANDAG Transportation Committee
- San Diego Metropolitan Transit System (MTS)
- San Diego Regional Airport Authority
- San Gabriel Valley Economic Partnership
- San Gabriel Valley Council of Governments
- Santa Clarita Council Study
- Southern California Association of Governments (and their Transportation Committee)
- Sierra Club
- SOAR Appreciation Night
- Southern California IT Professionals
- Southern California Transit Advocates
- STV-LA Union Station Webinar
- Los Angeles, San Diego, San Bernardino, Riverside and Orange County County Staff
- Taxpayers' Association Meeting
- Tustin-Santa Ana Rotary ClubVICA Local Officeholders Luncheon
- UCR Technical Team
- Urban Land Institute
- Women's Environmental Council
- WTS Leadership and WTS Luncheon

Other outreach efforts in this region include working with the Los Angeles mayor's office to develop a working group meeting with appropriate city department heads as part of the environmental screening process and holding briefings for all transportation, city, and environmental agencies relevant to the project.

# Ridership, Revenue and Operations

## Overview of Forecasts and Operations Planning

The ridership of a high-speed train system, the revenue it brings in, and its operations costs are all interconnected. Balancing the three elements determines how viable the system is as a business enterprise.

Ridership is a critical element. The Authority has previously sought ridership estimates of its planned system and is again working to develop updated ridership figures. Predicting ridership is a function of the state's projected population, future gasoline prices and airfare costs, and numerous other factors related to the physical design of the train system. Ridership, of course, is a determining factor, along with the cost of operations and maintenance of the system, in developing revenue. These figures will be critical in developing interest from private investors in the California high-speed train project.

This section discusses these important elements of the project.

The forecasts of high-speed train riders and revenue are developed from predicted future travel volumes and conditions within California, and future high-speed train operations planned. Being highly interdependent, the operations plans and the revenue forecast have been repeatedly refined to ensure consistency of assumptions and workability of the high-speed train service.

At the very beginning, a preliminary operations plan was drawn up with stations in major cities and trains running as often as in overseas systems serving similarly sized cities. Train fares were assumed to be somewhere between the cost of driving and of taking an airplane or train. Parking costs at stations were set at prevailing levels, and transit services that could connect at the stations were identified. Running times between stations were calculated from the specifics of the rail line grades and curves, the power, weight of the train, and top speeds of 220 miles-per-hour where the track is straight enough.

At the same time, a detailed picture of current and future trip-making in California without the high-speed train was developed. The volume of present travel among cities and rural regions was estimated from highway traffic counts, federal data on air trips, existing and new surveys of origins and destinations of trips, Caltrans data, and many other sources. The cost and speed of travel by air, car, and train, including getting to stations and airports and parking at destinations, was developed. Growth in traffic was projected from state forecasts of population, employment, and household income growth, and existing known relationships of these factors with travel volumes.

The end result was a computer-based model with the state divided into 4,500 zones with population, employment, and types of household classified by size, income, number of cars and other characteristics relevant to the choice of travel by car, air, or train. The time and cost of travel to every one of the other zone is included, as well as the number of trips made between the zones. There are over 10 million zone-to-zone pairs in the model for which specific conditions of travel can be calculated.

High-speed train operating speeds and cost were then added as a travel option to each of the zone-to-zone pairs, and the number of trips attracted to the train was estimated. An extensive U.S. and international body of re-search and experience exists on why people pick cars, planes, transit, or other ways to travel for a specific trip. To develop the forecast model, over 4,000 existing surveys of California inter-regional travelers were combined with 2,700 new surveys collected in

2005 specifically to determine their sensitivity to cost, speed, and convenience. Zone-to-zone trips attracted to the high-speed train are summarized by 14 major markets for ease of understanding, and are assigned to stations and trains.

The volume of high-speed train trips was then compared to the number of seats available in the operations plan. A relatively standard length of trains of around 660 feet has evolved in Europe and Asia. The number of seats ranges between 400 and 650, depending on seat spacing and whether the train is single or double level. Two sets can be coupled together to provide 800-1300 seats; the double trainset can be operated as a single. Where even two trainsets coupled together did not provide enough seats to carry the forecast traffic, trains were added to the preliminary operations plan. And where excess capacity was provided, consideration was given to reducing the frequency of service.

These changes in service can affect the attractiveness of the high-speed train, and to ensure compatibility, the ridership was re-forecast when service patterns were changed. This process has produced an operating plan that has enough capacity to handle the forecast.

This forecast and operating plan for an initial phase of service between Anaheim and San Francisco are based on using single-level trainsets either singly with 450-500 seats each or two sets coupled together with 900-1,000 seats. In the year 2035, 270 trains operate throughout the day, in a mix of express non-stop service and shorter-distance limited service. The fastest running times meet legislative mandates, such as the 2 hours and 40 minutes time between San Francisco and Los Angeles. In the peak hours eight trains an hour are operating in each direction between Los Angeles and San Francisco, with another two trains an hour each way on the Merced segment, one to LA and the other to San Francisco. Four trains an hour in each direction would run through to/from Anaheim.

High-speed train fares are a key factor in the level of ridership and the revenue forecast. Forecasts for the programmatic EIR/EIS work used fares based on an LA–SF fare at half (50 percent) of the 2005 air fare, and varied proportionally with distance for other trips. This "50 percent" fare level generates relatively large passenger flows without requiring operating subsidy, and creates large public benefits from the public investment (e.g., air quality improvements, energy consumption reductions, and travel time savings). It also ensures that local and regional impacts of the high-speed train on items such as traffic, parking, sensitive lands, and water resources are not understated.

Tests of the sensitivity of riders and revenue to fare levels 33 percent higher and 66 percent higher than the "50 percent" base level showed progressively higher revenue, although lower ridership. The 66 percent higher case (which becomes the "83 percent" of air fare case) appears to be near the level that will generate the highest revenue, and reduces the operating costs and the number of trainsets needed. Because of the importance of increasing the amount of private sector funding in the construction and procurement of the project, the 83 percent fare scenario was adopted for this business plan. The fare is calculated in the same manner as the 50 percent, but is anchored by an LA-SF HST fare at 83 percent of the air fare, or in 2009 dollars a high-speed train fare of $105 vs. a $125 air fare, and a $118 cost to drive.

Riders and revenues are presented below for the year 2035, as well as for start-up in the year 2020. Although early service may be possible on certain segments, no such revenues or operations have been included in this plan.

The remainder of this section presents more detail on the methodology and results for the ridership and revenue, the detailed operations plan, the operations costs, and the resulting cash flow for the initial phase between Anaheim and San Francisco.

## Schematic Operations Plan for Ridership and Revenue Forecasting

In order to prepare a ridership and revenue forecast, a schematic operations plan is needed, providing how often trains will run, which stations they will stop at, and how long they take between station stops. This is done both for the peak morning and afternoon travel times, and for an off-peak period for the remainder of the day. Table A shows the schematic operations plan developed from ongoing ridership and operations planning for the initial phase of service in the peak period southbound. The northbound service plan mirrors the southbound.

This peak-period plan features different trains to serve the many different ridership markets in the initial service phase. Many different combinations are possible because of the flexible design of the alignment that lets express trains pass local trains in stations. This pattern has evolved incrementally and provides the highest ridership levels to date. An hourly non-stop train (pattern "0") provides the fastest possible service between San Francisco downtown and Los Angeles downtown, taking 2 hours and 40 minutes, the legislatively-mandated time. A second San Francisco–Anaheim express (Pattern "2") provides rapid service to San Jose, and continues to Anaheim. Pattern "1" provides San Francisco and the mid and southern Peninsula stations with rapid service to Los Angeles, Norwalk, and Anaheim. Pattern "4" provides Fresno and Bakersfield with half-hourly semi-express service to San Jose, San Francisco, and Los Angeles. Pattern "6" serves the northern LA basin stations as well as the line to Orange County. Patterns "7" and "8" provide service to Merced from the Bay Area and from the south. In all, nine patterns of service are provided in this scenario, eight starting in San Francisco and one in Merced. It is designed to provide at least several trains per hour between all possible station pairs, while offering non-stop service between the major markets and a frequent mix of local and few-stop services within the constraints of the system's capacity.

This peak schematic pattern provides 57 trains in each direction in 6 hours, for an average of just under 10 trains per hour. The off-peak for the initial phase of service provides 71 trains in each direction over a 10-hour period, for an average of 7 trains an hour.

For each pattern of service, the time for each train service was calculated from the curvature and grade of the current preferred programmatic EIR/EIS alignment, and the ability of a standard high-speed train set currently in revenue service elsewhere in the world to accelerate, maintain top speeds, and brake comfortably and safely. Time was added at stations for picking up and dropping off passengers depending on the expected size of the flows, and in some cases, to allow overtaking by express trains while stopped trains are at the station platforms. Finally, a little extra time was added to allow for unexpected delays in boarding or operation. This operations recovery time is equal to roughly 3.5 percent of the normal trip time. The resulting run times are realistic and achievable with high reliability and with the expected performance improvements from the next generation of high-speed trains being brought into revenue service in Europe and Asia.

**TABLE A** – Initial Section Schematic Operations Plan for Ridership Forecasting-Peak Period, Southbound

| Pattern# | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| Frequency of service (mins) | 60 | 120 | 60 | 120 | 30 | 60 | 120 | 40 | 40 |
| | Run times from start in minutes | | | | | | | | |
| San Francisco | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Milbrae | \| | \| | \| | 15 | 15 | \| | \| | 15 | |
| Redwood City / Palo Alto | \| | 20 | \| | 25 | \| | 20 | 20 | 25 | |
| San Jose | \| | 35 | 30 | 40 | 35 | 35 | 35 | 40 | |
| Gilroy | \| | 51 | \| | 56 | \| | 51 | \| | 56 | |
| Merced | | | | | | | | 91 | 0 |
| Fresno | \| | \| | \| | 97 | 87 | \| | \| | | 22 |
| Bakersfield | \| | \| | \| | 136 | 126 | \| | \| | | 61 |
| Palmdale | \| | \| | \| | \| | \| | 151 | 145 | | 95 |
| Sylmar | \| | \| | \| | \| | 175 | \| | 167 | | 117 |
| Burbank | \| | \| | \| | \| | \| | 179 | 176 | | 126 |
| Los Angeles Union Station | 160 | 175 | 163 | 194 | 189 | 188 | 185 | | 135 |
| Norwalk | | 188 | \| | 207 | | | 198 | | 148 |
| Anaheim | | 200 | 184 | 219 | | | 210 | | 160 |
| # of trains | 6 | 3 | 6 | 3 | 12 | 6 | 3 | 9 | 9 |

The high-speed trains operating on this pattern are assumed to be of the standard length of around 660 feet that has evolved in Europe and Asia, with a single level and seating comfortable by U.S. standards, resulting in either a single set with 450-500 seats, or two such sets coupled together, for a total seated capacity of 900-1,000. At this schematic stage, capacity for each pattern was not specified, but the later matching of forecast ridership to a detailed timetable verified that this schematic pattern was able to accommodate growth in demand to 2035, as well as to provide full initial system service in earlier years.

## Ridership and Revenue Forecasts

The high-speed line and stations are shown in the map below, along with fourteen regions into which the state was divided for purposes of reporting the results of the ridership and revenue forecast model. The model forecasts trips among 4,667 smaller zones for the year 2030, which are then factored to 2035 by the projected growth in population and employment of the various regions of California.

Base forecasts of riders and revenue for the high-speed train were developed from 2005

to 2009 by Cambridge Systematics (CS), a national leader in transportation economics and modeling, with extensive current experience in transportation issues throughout California.

CS developed a detailed 4,667-zone model for the entire state to forecast travel between regions. The economic and household characteristics were forecast for each zone in the year 2030 based on data and forecasts from state, regional, and local government agencies.

A detailed description of system capacity, speeds, service levels, cost, and traffic congestion for the highway and local transit networks was developed for 2030 from the fiscally constrained long-range transportation plans of each regional planning agency.

Finally, future air and intercity conventional rail service reflecting current service levels and planned investments were incorporated.

The high-speed train line and stations were added using fares, travel times between stations, and time between trains, provided by the Authority and validated by an independent peer review panel.

In 2005, data on travel conditions and patterns were collected from California agencies, and 3,170 state-of-the-art surveys were taken of air, auto and intercity rail travelers who had recently made an intercity trip in California.

The data were used to develop sensitivities for each of over 1,200 separate types of traveler and trip, involving combinations of:

- Purpose of the trip (Business, Commute, Recreation, and Other)
- Trip distance and size of metro area (More than 100 miles; less than 100 miles and from large metro area; less than 100 miles and from small areas)
- Household characteristics
  - size (1 person, 2, 3, and 4 or more)
  - income (low, medium, and high)
  - autos owned (none, 1, and 2 or more)
  - number of workers (0, 1, and 2 or more)
- Travel party size (alone, and with others)

For all travelers, cost, trip time, and frequency of departure are the more important variables, and reliability is a smaller, but significant, influence on the mode chosen to make a trip.

For forecasting high-speed train travel within the greater LA Basin and the Bay Area, the existing urban transportation models for each of the regions were updated in 2008 and high-speed train service was added as an option.

Travel within San Diego County was forecast using an extrapolation methodology because of the relatively low number of expected high-speed train trips.

A peer review panel of local, national, and international travel model and high-speed train experts reviewed and commented on the modeling assumptions, methodologies, and results during each stage of model development. The panel concurred with the approach and reasonableness of results.

In the year 2000, more than half a billion trips were made among California's regions, 95 percent by car, 4 percent by air, and 1 percent by intercity conventional rail, (San Joaquin, ACE, Capital Corridor and Pacific Surfliner). Between 2000 and 2030, population is forecast to grow by 42 percent to 48 million, and employment will grow by about 51 percent. This growth will increase total interregional travel by 65 percent to 911 million trips a year, with auto keeping its lion's share, but with a nearly five-fold increase in conventional rail trips.

The forecast population and economic growth will also increase travel within the three major metropolitan areas that have several high-speed train stations. Within the Los Angeles/Orange region, over 20 billion auto trips will be made in 2030, 34 percent more than in the year 2000, and conventional rail trips will grow five-fold. In 2030 the Bay Area will see over 7 billion auto trips and the San Diego region over 8 billion trips. Conventional rail traffic will grow much faster than auto trips but from a much smaller base.

Highway, transit and air capacity are not projected to keep pace with the expected increase in trip making, leading to increases in driving times within and between regions. In particular, peak period travel within and through major urban areas will take longer. Airplanes and trains are likely to become more crowded, and air travel times may continue to slow as airport congestion grows.

With high-speed trains in service in 2030, air travel will take about the same amount of time and be as frequent as it was in 2005. Air travelers will also continue to arrive at the terminal approximately 75 minutes before scheduled closing of airplane cabin doors as indicated in 2005 air traveler surveys. Flight reliability will also remain at 2005 levels, with about 95 percent of flights arriving within an hour of schedule. The forecasts assume that high-speed train travelers will not face airport-style security checks and processing time, in line with practice in the Washington-New York-Boston 150-mph Acela train services, and all but one of the high-speed train services overseas[19].

In 2030, Amtrak and other conventional rail trips between regions will take the same time and have as many trips as in 2005. The wait time for trains will be in line with the current 15 minutes, with no airport-style security measures. For rail service within regions, future running times and frequencies will be improved to the levels in each region's long-range transportation plan.

Baseline year 2030 air, auto, and conventional rail costs were developed based on the relative competitive situation of 2005 and assumptions about future trends as described below. A baseline high-speed train fare structure was set by the Authority and reviewed for reasonableness by an independent peer review panel.

**The cost of driving** is assumed to increase in line with general inflation, and to remain at 2008 levels (8 percent higher than the 2005/6 levels in real terms, or 24 cents per mile for each auto traveler (2005 dollars) reflecting gasoline at just over $3 per gallon (2005 dollars). Bridge tolls were assumed to remain at 2005 real levels. Auto trips were assumed to pay market-based parking charges ranging from $0 to $35 per trip, depending on employment density at the destination. These driving and parking costs also apply to air, conventional rail and high-speed train travelers who drive a private vehicle or rental car from the station to/from their final destination.

**Air fares** were obtained for 2005 from the Federal Aviation Administration 10 percent sample of collected tickets for each of the airport pairs in California. Parking costs at airports were assumed to remain at their 2005 levels in real terms.

**Conventional rail fares** for the baseline in 2030 were assumed to be equal to the per-ride cost of a current multi-ride ticket, except for the Amtrak San Joaquin and Pacific Surfliner Routes, for which full one-way ticket costs were assumed. Parking costs at stations were assumed to be similar to 2005, in real terms.

**Baseline high-speed train fares** for trips between regions were originally set so that the LA-to-San Francisco fare would be half of the average air fare from the LA Basin airports to Bay Area airports, or $55 in 2005 dollars. Fares for other trips between regions were then calculated using a formula derived from this fare, with a fixed boarding charge of $15 plus a per-mile cost of 9 cents. For trips wholly within the Los Angeles Basin, San Diego County, or Bay Area, a lower fare was set with a $7 boarding fee plus 6 cents per mile.

**Parking costs** for inter-regional high-speed train travelers were set from $3 for the smaller, less urban stations to a high of $32 for San Francisco Transbay Terminal. For interregional travel, parking was set at $3 Work is underway to better reflect actual market rates for private structured parking in mixed use areas similar to the anticipated development around each station and airports in the 2030 2035 horizon.

19 Only the Paris-London service using the 20 mile English Channel Tunnel screens passengers and bags because of the [illegible] of length, shared use with freight trains carrying cars and trucks, and deep underwater factors

Before actual revenue service begins, the Authority will make a decision on fares based on market conditions, including a determination of the point at which higher fares reduce ridership enough to be no longer cost-effective. For the 2009 business plan, we have chosen a single relatively high train fare for purposes of presenting a revenue and ridership scenario. Fares are assumed to be 83 percent of the average air fare for the LA-SF market, and other fares are set proportionally to distance[20]. This scenario generates more revenue than the 50 percent of air fare scenario presented in the 2008 business plan and the operating costs are lower, thus increasing the operating surplus. Additionally, fewer trainsets are needed to generate the revenue and the amount of private financing that could be attracted is increased. The resulting fares and air and auto costs are shown in Table B.

Table B

AVERAGE HST & AIR FARES, AND AUTO COSTS IN 83% FORECAST, SELECTED MARKETS (2009 $$)

| Travel Market | Miles | HST | Air | Auto |
|---|---|---|---|---|
| San Francisco – Los Angeles | 432 | $104.75 | $125.75 | $118.50 |
| Anaheim – San Jose | 417 | $102.50 | $105.25 | $114.50 |
| Bakersfield - Burbank City | 131 | $51.25 | n.a. | $42.00 |
| Fresno - Millbrae | 174 | $58.75 | n.a. | $47.75 |
| Merced -Sylmar | 287 | $77.75 | n.a. | $78.75 |

The 83 percent level is in the middle of a wide range of experience in similar-length markets outside of California, based on prices examined in 2007[21]. At the top end, weekend Acela fares in the New York to Washington market were higher than air fares, and the Japanese Shinkansen fares were 108 percent of air fares for Tokyo-Osaka (322 miles) and 114 percent Tokyo-Hakata (722 miles). London – Paris Eurostar HST fares were 80 percent of air fares, both peak and off-peak. Madrid – Sevilla (333 miles) AVE fares were 71 percent of air, and Paris Lyon (244 miles) 71 percent of air. In the Paris Brussels market (191 miles) where HST has 95 percent of the air/rail market, and airlines are primarily connecting to long-distance flights, (similar to Central Valley service to San Francisco or San Diego-Los Angeles flights) air fares are very high, and HST fares were only 39 percent of air fares.
Fares for each trip continued to be expressed as a single average fare. Future modeling will reflect the ability to vary fares according to types of service and peak periods, in the way that air fares worldwide, high-speed train fares overseas, and Washington-New York-Boston train fares are varied today. Typically this will increase passenger revenue, encourage travel before or after peak traffic periods on less heavily loaded trains, and reduce operating costs due to peaking. It also has the advantage of making high-speed train travel more affordable to those willing and able to shift their travel in time and use trains that stop more frequently.

Additional work was done to extend the time horizon of the forecast to 2035 for purposes of the environmental analysis. Since most metropolitan planning entities in the state have not yet completed updating their long-term transportation plan from 2030 to 2035, and some have not yet completed population and employment forecasting updates to 2035, the full model was not rebuilt, but a region-by-region forecast of growth was made from available government and private forecasts[22] and applied to the model forecasts of 2030. Notably growth from 2030 to 2035 is forecast to slow to below 1 percent per annum compared to 1.5 percent forecast for the prior decade.

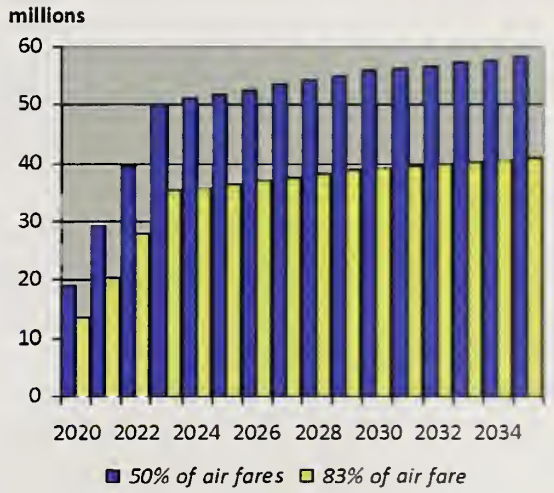
Using this approach and assumptions, forecasts were developed for an initial phase of service between San Francisco, San Jose, the Central Valley (2including Merced), Los Angeles, and Anaheim. The riders are shown in Figure 1 for both the 50 percent and the 83 percent of air fare scenarios; the revenues are shown in Figure 2. In addition to a year 2035 forecast, growth is shown from 2020, the first full year of service for the initial phase.

20 However, the assessment of environmental impacts and mitigations continues to be based on the 50 percent scenario because it carries more riders and represents the reasonable maximum impact scenario required to be analyzed.
21 "HSR diversion of traffic from air," Brand, N., working paper, July 5, 2009.
22 For AMBAG, MTC, Kern, and SCAG, forecasts of regional population, total employment, and households were obtained from the respective MPOs. Since 2035 MPO forecasts had either not been produced or adopted for the remaining regions; 2035 regional forecasts for those regions were developed using information from Woods and Poole Economics, Inc.

## Figure 1 Passengers per year – Initial Phase

Just as they have following startups of high-speed train services overseas, riders and revenues are assumed to ramp up from the first year of service to the 4th. From 2025 to 2035 volume grows at the rates described in the previous paragraph.

With fares at 50 percent of air, 58 million passengers are forecast in 2035; with the higher fares at 83 percent of air, 1/3 fewer passengers use the service, or 41 million per year.




## Figure 2 Revenues per year – Initial Phase

But because fares increase more than riders decline, the 83 percent fare level produces 13 percent more revenue, $2.87 billion in 2035 (2009 dollars), compared to $2.4 billion for the 50 percent fare scenario.

Interregional trips account for more than 70 percent of the trips and 90 percent of the revenue, as seen in Table C. Local trips within the LA Basin and within the Bay Area are much shorter than between-region trips, and have a lower per-mile fare, which accounts for the lower revenue from each local traveler.

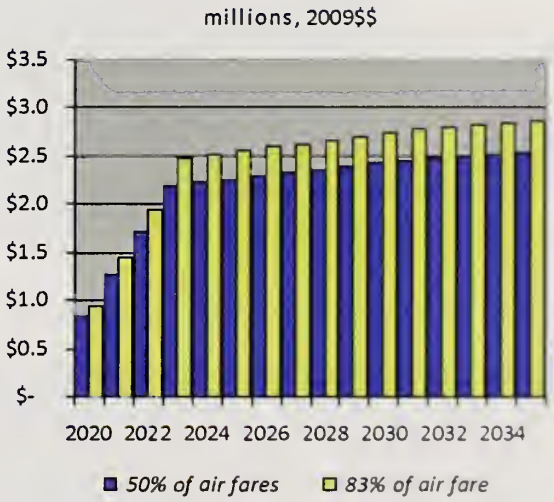


**Table C** RIDERS & REVENUES BY MARKET, INITIAL PHASE, 2035, Fares 83% of Air

| Market Pairs (Ultimate trip ends) | Riders (millions) | Revenues (millions, 2009$$) |
|---|---|---|
| LA Basin – Bay Area, with intermediate markets | **23.4** | **$2,095** |
| *LA Basin - Bay Area* | *7.9* | *$900* |
| *San Joaquin Valley - LA Basin* | *6.3* | *$467* |
| *Bay Area - San Joaquin Valley* | *5.8* | *$458* |
| *Monterey Bay / Central Coast - LA Basin & Bay Area* | *2.9* | *$238* |
| *Within San Joaquin Valley* | *0.5* | *$32* |
| San Diego region - Bay Area | 2.0 | $234 |
| LA basin – Sacramento region | 1.2 | $143 |
| Other Inter-regional | 1.5 | $86 |
| North & Sierra regions - LA Basin | 0.5 | $43 |
| Sacramento region - San Joaquin Valley | 0.5 | $42 |
| ***Inter-regional subtotal*** | ***29.1*** | ***$2,643*** |
| within LA Basin | 7.9 | $152 |
| within Bay Area Peninsula | 4.0 | $76 |
| ***Local within-region subtotal*** | ***11.9*** | ***$228*** |
| **Total Initial Phase** | **41.0** | **$2,871** |

Source: High-Speed Rail Authority Program Management Team, 2009

**Table D** DAILY STATION BOARDINGS, INITIAL PHASE 2035, Fares 83% of Air

| Station | Total | Inter-regional | Local |
|---|---|---|---|
| San Francisco Transbay | 24,100 | 20,600 | 4,400 |
| Millbrae | 2,500 | 900 | 1,600 |
| Redwood City | 3,900 | 2,400 | 1,600 |
| San Jose | 7,600 | 4,700 | 3,100 |
| Gilroy | 4,700 | 3,800 | 1,100 |
| Merced | 5,300 | 5,600 | - |
| Fresno | 4,500 | 4,700 | - |
| Bakersfield | 5,100 | 5,300 | - |
| Palmdale | 12,900 | 5,500 | 7,700 |
| Sylmar | 5,100 | 3,300 | 2,000 |
| Burbank | 2,900 | 800 | 2,200 |
| Los Angeles Union Station | 14,100 | 3,800 | 10,400 |
| Norwalk | 4,500 | 3,000 | 1,600 |
| Anaheim | 23,500 | 19,100 | 5,300 |
| Daily | 120,700 | 79,700 | 41,000 |

Source: High-Speed Rail Authority Program Management Team, 2009

Boardings by station by local and interregional travelers are shown in Table D. In the initial system San Francisco and Anaheim attract over 24,000 boardings daily with 80 percent interregional travelers. The second tier of stations includes Palmdale and Los Angeles Union Station with over 12,000 passengers boarding daily, more than half of whom make shorter trips within the Los Angeles Basin. The three Central Valley stations serve only interregional travelers, with between 4,700 and 5,600 daily boardings. The other stations, ranging from San Jose with 7,500 boardings at the upper end, to Millbrae at the lower with 2,300 boardings, serve predominantly interregional travelers.

Table E shows the growth of riders and revenue by year. Riders and revenues are assumed to ramp up from 2020, the first full year of service to 2023, similar to start ups of high-speed rail service overseas. Until 2030, traffic volume continues to grow by 1.5 percent per year, and from 2030 to 2035 is forecast to slow to below 1 percent per annum. Although not included in the table, some of initial phase sections may be able to start earlier in 2019, and would generate small amounts of riders and revenue.

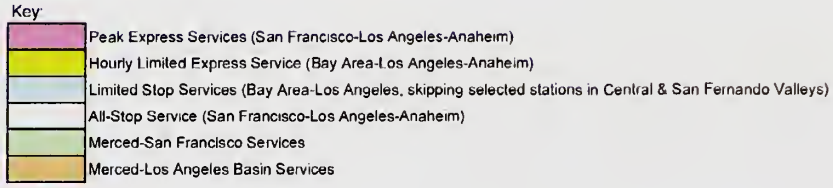
**Table E** INITIAL PHASE RIDERS & REVENUE BY YEAR, Fares 83% of Air

| Year | Riders (millions) | Revenues (billions 2009$$) |
|---|---|---|
| 2019 | 0 | $0.00 |
| 2020 | 13.5 | $0.95 |
| 2021 | 20.6 | $1.44 |
| 2022 | 27.9 | $1.95 |
| 2023 | 35.4 | $2.48 |
| 2024 | 35.9 | $2.51 |
| 2025 | 36.5 | $2.55 |
| 2026 | 37.0 | $2.59 |
| 2027 | 37.6 | $2.63 |
| 2028 | 38.1 | $2.67 |
| 2029 | 38.7 | $2.71 |
| 2030 | 39.3 | $2.75 |
| 2031 | 39.6 | $2.77 |
| 2032 | 40.0 | $2.80 |
| 2033 | 40.3 | $2.82 |
| 2034 | 40.7 | $2.84 |
| 2035 | 41.0 | $2.87 |
| Source: High-Speed Rail Authority Program Management Team, 2009 | | |

## The Detailed Operations Plan

The detailed operations plan incorporates the schematic operating pattern shown earlier for ridership forecasting. The types of trains in the pattern (express, local, limited-stop) were arranged into a repeating hourly "clock-face" pattern to make the service more regular and predictable, and to reduce the number of different kinds of overtakings (i.e., express trains passing limited trains) that would be required. The minimum time between trains following each other past a given point was set at three minutes, based on the practical capacity of the signal and train control system. Overtakes were arranged at intermediate stations, with local stopping trains pulling off the main track to the platform, allowing the non-stop train to pass. Although stations stops were swapped among some of the local and limited stop trains to make the schedule work better, the service levels between station pairs were kept at the same level. Figure 3 shows a typical morning peak hour of the detailed operational timetable, running south from San Francisco Transbay and the spur from Merced joining the main line north of Fresno.

**Figure 3** Initial Section Typical A.M. Peak Hour Timetable, Southbound




**Bay Area to L.A. Basin**
**Bay Area to Merced**
**Merced to L.A. Basin**
**SOUTHBOUND**

| | | Direction → | SB | SB | SB | SB | SB | SB | SB | SB | SB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Trainset → | T18 | T19 | T22 | T9 | T20 | T21 | M1 | T23 | T24 | T25 |
| | | Train No. → | S010700 | S290703 | S020730 | S150708 | S290708 | S040711 | S210733 | S180737 | S140752 | S010800 |
| | | Pattern → | 1 | 29 | 2 | 15 | 28 | 4 | 21 | 18 | 14 | 1 |
| Southbound | | Service Type → | Limited Express | Limited | Express | Merced All-Stop | Limited | All-Stop | Limited | Limited | Merced All-Stop | Limited Express |
| Station | | | | | | | | | | | | |
| SFT | S.F.-Transbay | Dep | 7:00 | 7:03 | 7:27 | | 7:08 | 7:11 | 7:33 | 7:37 | 7:52 | 8:00 |
| SFO | Millbrae | Dep | -- | -- | | | 7:23 | 7:26 | -- | 7:52 | 8:07 | -- |
| RWC | Redwood City | Dep | 7:21 | 7:24 | | | 7:31 | 7:34 | -- | 8:00 | 8:15 | 8:21 |
| SJC | San Jose | Dep | 7:35 | 7:38 | | | 7:45 | 7:48 | 8:05 | 8:14 | 8:29 | 8:35 |
| GLY | Gilroy | Arr | | | | | | | | | | |
| | | Dep | 7:50 | 7:53 | | | 8:00 | 8:03 | 8:21 | 8:29 | 8:44 | 8:50 |
| MCD | **Merced** | Dep | | | | | | | | | 9:19 | |
| MCD | **Merced** | Dep | | | | 7:59 | | | | | | |
| FNO | Fresno | Arr | | | | | | 8:40 | | | | |
| | | Dep | | | | 8:20 | 8:38 | 8:45 | | 9:07 | | |
| BFD | Bakersfield | Arr | | | | 8:56 | | | | | | |
| | | Dep | | | | 9:01 | -- | 9:21 | 9:30 | -- | | |
| PMD | Palmdale | Arr | | | | | 9:40 | 9:52 | | | | |
| | | Dep | | 9:30 | | 9:34 | 9:43 | 9:54 | 10:03 | 10:10 | | |
| SYL | Sylmar | Arr | | | | | | | | | | |
| | | Dep | | 9:46 | | 9:50 | -- | 10:10 | 10:18 | -- | | |
| BUR | Burbank | Arr | | | | 9:56 | | | | | | |
| | | Dep | | -- | | 9:59 | -- | 10:17 | 10:25 | 10:29 | | |
| LAU | **L.A. Union Station** | Arr | 9:47 | 9:58 | 10:05 | 10:08 | 10:10 | 10:26 | 10:34 | 10:38 | | 10:47 |
| | | Dep | 9:48 | 10:00 | 10:06 | 10:09 | 10:11 | 10:27 | 10:35 | 10:39 | | 10:48 |
| NSF | Norwalk | Arr | 9:55 | | 10:13 | 10:16 | 10:20 | 10:34 | | | | 10:55 |
| ANA | **Anaheim** | Arr | 10:10 | | 10:28 | 10:32 | 10:35 | 10:49 | | | | 11:10 |

To help ensure that the timetable could be operated reliably and efficiently, a "string-line diagram" was plotted, showing the path of each train from start to finish (vertical axis) over time (horizontal axis). This diagram is especially useful in ensuring that express trains overtake local trains running in the same direction at a station. Figure 4 shows the morning's start of operation on the main line in both directions between San Francisco (top) and Anaheim (bottom). A good example of overtaking is the first train from Anaheim (red line), leaving at 5:05 a.m. northward (up and to the right) to San Francisco. It overtakes a northbound local train (in yellow) that is stopped at Bakersfield at 6:20 a.m. (Incidentally, the first southbound train from Merced (green) passes through the station at the same time on the other express track.) The express also catches up to and overtakes a northbound (blue) train stopped at Gilroy at 6:35 a.m. Working with the timetable and stringline diagram produced a realistic detailed operational timetable for operations and the basis for estimating how many trainsets are required.

Determining the number of trainsets required for the service involved three separate calculations:

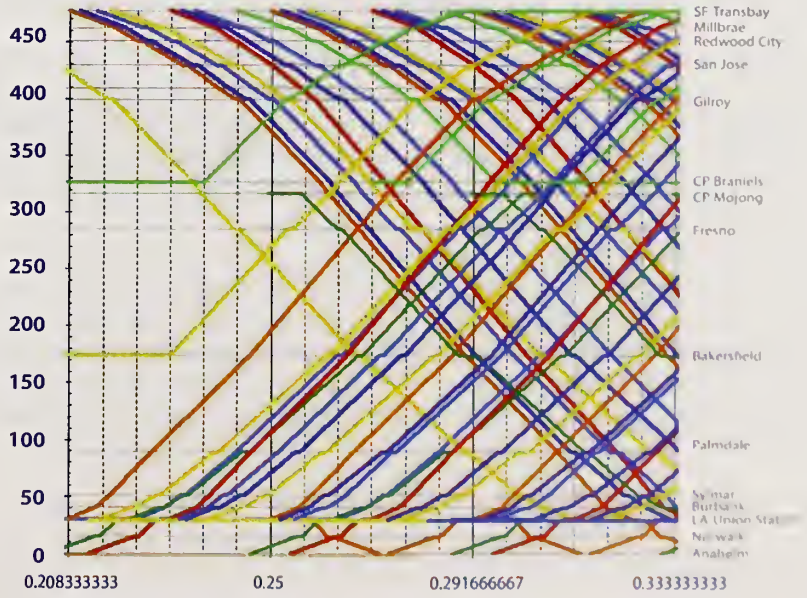
1. the basic number of trainsets needed to handle this timetable
2. how many of those trainsets would need two sets to handle the ridership demand, and finally,
3. the number of sets needed to cover service while others are in periodic preventive maintenance as well as to provide back-up to cover mechanical and other problems

The basic number of trainsets to handle the timetable was calculated by assigning each departure to a specific trainset, noting the trainset arrives at the destination, and assigning it another departure in the other direction.

At the start of the day, each departure will require a different trainset, but after several hours, trains will have arrived from the other end, and will be available to handle a departure after being inspected and cleaned.

The standard minimum times needed at each station for disembarking passengers, trainset cleaning and safety work, and boarding a new load of passengers are shown in Figure 5. They are derived from high-speed train servicing requirements from overseas operators and manufacturers, U.S. practices in serving and marshalling customers, U.S. experience in organizing staff and their work, and likely U.S. regulatory requirements. They do not assume the large cleaning staff and race-car pit-stop-style operation at peak hours in busy stub stations like Tokyo South, where up to 13 trains leave in one hour from two platforms.

**Figure 4** Initial Section String-line Diagram Excerpt



Trainsets arriving in the station from servicing at the maintenance facility, typically at the start of each peak, need only about half of this time in the station before departure.

**Figure 5** Trainset Turnaround Time Assumed

| Code | Station | Minimum Scheduled Layover Time (mins) |
|---|---|---|
| SFT | S.F.-Transbay | 30 |
| LAU | L.A. Union Sta. | 40 |
| ANA | Anaheim | 40 |
| MCD | Merced | 40 |

Most trainsets are able to make 3-5 trips between the Bay Area and Los Angeles Basin in a day. Operations to Merced turn for the next available departure to the alternate terminal (i.e., a San Francisco-Merced train will turn for a Merced-Anaheim train). A total of 65 trainsets are needed to handle the service, before accounting for second sets, spare sets to provide service in case of mechanical problems, and out-of-service maintenance needs. The next step was to determine how many trains required the doubling of capacity by coupling a second trainset. The forecast daily 2035 ridership for the 83 percent fare scenario was distributed to each hour of the day, using factors from experience with high-volume rail traffic in the Northeast Corridor New York to Washington, high-speed services overseas, and California travel patterns. Separate factors were developed for the peak morning and afternoon hours, the hours before and after those peaks ("peak shoulder" hours), and off-peak hours.

Table F shows the percentage of traffic assigned to each of these hours for the three major high-speed train markets. To illustrate, interregional traffic, which is more evenly spread out through the day than traffic within the Bay Area or the LA Basin, has 12 percent of the day's traffic assigned to each peak hour, whereas the more commuter-oriented local markets have 15-17 percent in each peak hour. Over half of the traffic is expected in the 6 peak hours for each of the market type, and the remainder is in the 10 off-peak hours.

**Table F** Ridership Peaking Factors for Capacity Calculations

| Travel Market | Peak hour % of daily (each) | Peak Shoulder hour % of daily (each) | 6 hours peak period % of daily | 10 hours off-peak period % of daily |
|---|---|---|---|---|
| Inter-regional trips | 12% | 10% | 54% | 46% |
| Within-MTC trips | 17% | 11% | 67% | 33% |
| Within SCAG trips | 15% | 10% | 61% | 39% |

Higher capacity is needed in both the MTC and SCAG regions because a peak direction1 can be expected, based on existing flows of traffic. The strongest peaks are in the local MTC traffic, which is heavier out of San Francisco in the afternoon (and into the city in the morning) and requires 20% more seats than the average of both directions would have indicated. Traffic in the Los Angeles basin (SCAG ) is expected to need 10% more seats in one direction than the average. On the other hand, the inter-regional traffic is equally heavy in both directions at the peak, and no additional seats are required. The cumulative effect of these peaking assumptions is to require nearly three times as many seats at the peak hour in the peak direction as would be indicated by the use of an average hour during the day.

For each of the three types of hours above, ridership was assigned to the available service patterns operating during those hours. Trips were first assigned to the fastest trains available, (i.e., Los Angeles–San Francisco passengers were



23 Capacity was defined as 95 percent of the available seats at the peak point in a train's trip, a reasonable average at this planning stage allowing for daily fluctuation. Use of demand management systems and capacity related-pricing will be needed to implement this, as is done today on HST and airlines worldwide.

assigned to the non-stop express train, San Jose to Anaheim to the two limited stop trains, Fresno–Norwalk to the pattern 28 limited train and so forth). The loads were then compared to the capacity[23] to determine whether one set (500 seats) or two (1,000 seats) were needed.

Where this initial assignment resulted in even two-set trains being over capacity, the overflow passengers were reassigned to the next fastest trains with available seating capacity operating within the same hour.

Figure 6 shows the results of the loadings for a peak hour in 2035 when the traffic is heaviest. In all cases, passenger loads can be kept within the 1,000 seat capacity of a double trainset. The express services require double trainsets all day long. The Central Valley limited-stop trains and the Anaheim-Merced local trains also have sufficient peak passenger loads to require double trainsets. The all-stop local is at the edge of needing two sets, but the remaining services can be handled with a single trainset. Northbound services mirror the southbound with the a.m. and p.m. peaks reversed.

**Figure 6** Initial Section train loadings for peak evening hour southbound, 2035, HST Fares 83 % of Air

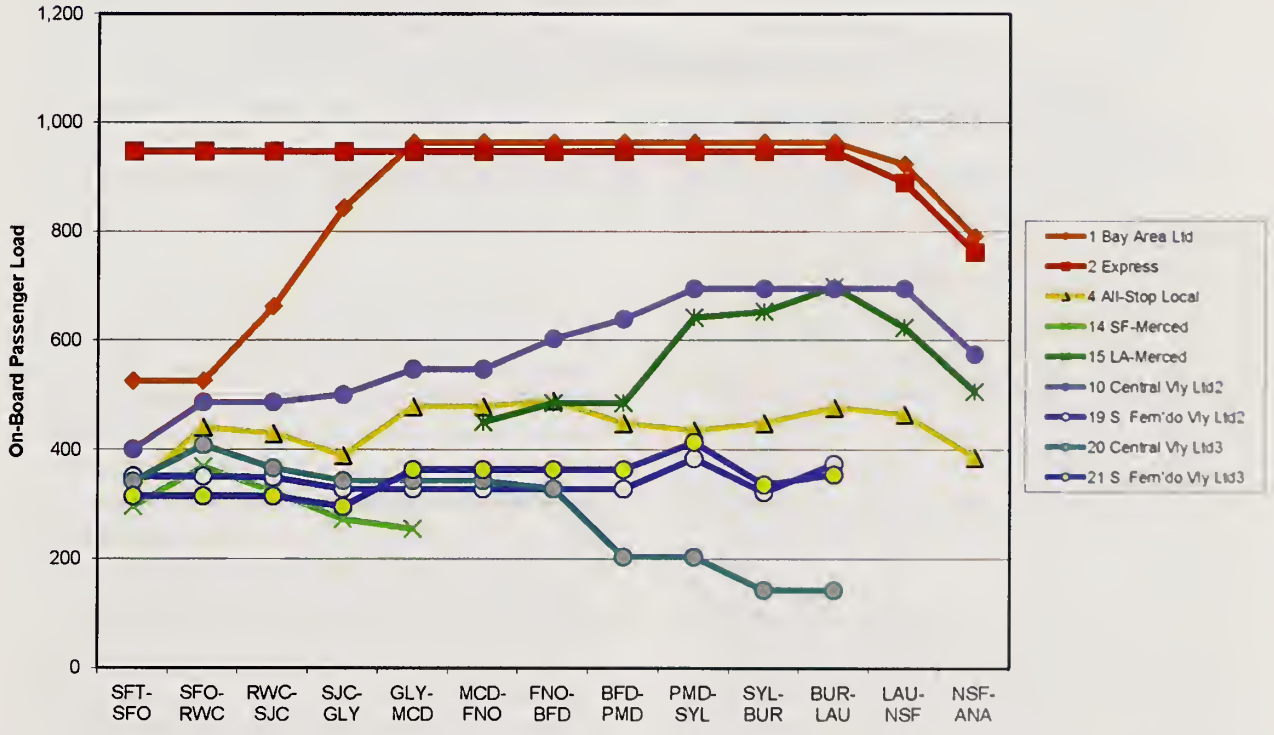


**Figure 7** Initial Section train loadings for off-peak north & southbound, 2035, HST Fares 83% of Air

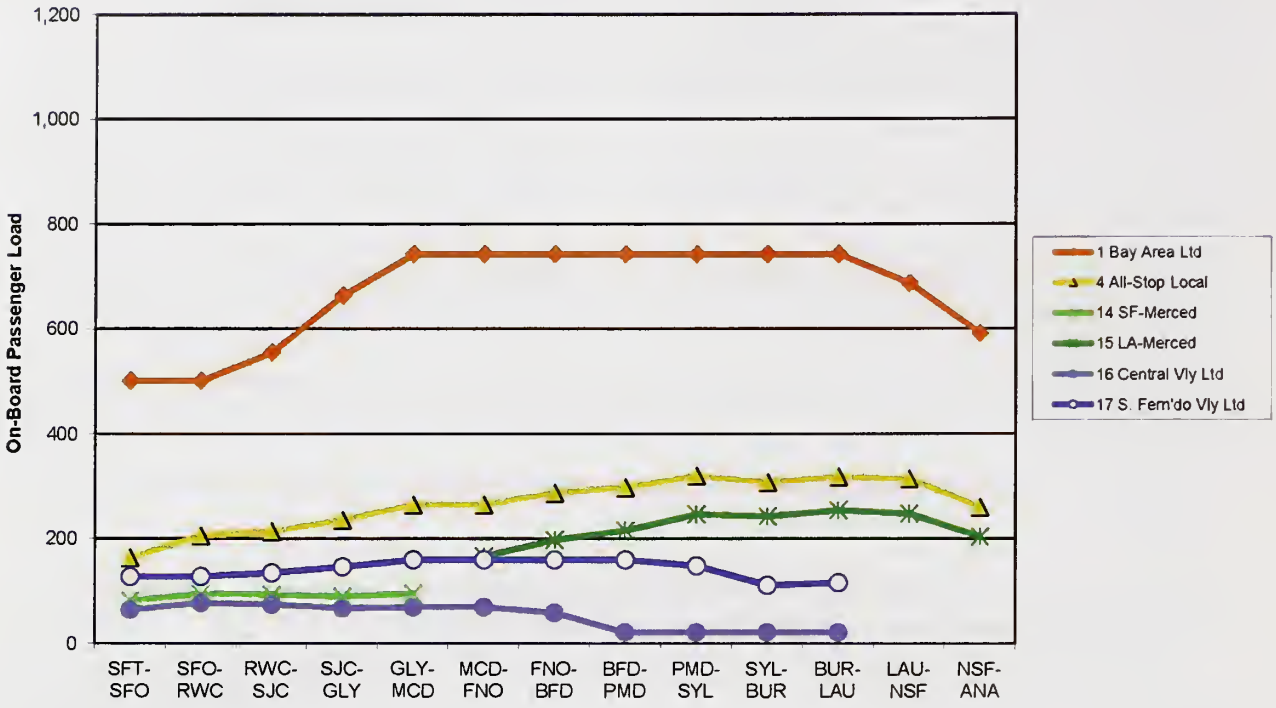



Figure 7 shows the same information for the off-peak service pattern and loadings, where it is clear that significant additional capacity is available. All off-peak trains other than the hourly limiteds have passenger loads under 95 percent of the 500 seats and can be accommodated on single set 660-foot-long trainsets.

In all, 23 additional trainsets are required to provide double trainset operation with 1,000 seats at the peak hours. When added to the base operating requirement of 67 sets, the total number of sets needed for service during the day is 90.

In addition to the sets needed for each day's operations, additional sets must be available to account for the time that is needed to periodically inspect and maintain the trainsets, to perform less frequent but longer overhauls, and to a lesser extent, to provide spares to ensure operation in case of mechanical failure of a set. The conventional approach at this stage of planning is to add a number of sets calculated as a percent of the total, typically 10 percent. An additional check was made to ensure that the average number of miles operated by each trainset was reasonable given the specifics of the California operation, estimated as 430,000 miles per set per year. This resulted in a requirement for an additional 10 sets to cover maintenance and operations protection needs in 2035, or a total of 100 trainsets in the fleet.

The operating plan was completed by identifying where trainsets would be stored overnight and at midday: some at stations, some in stations, and some in the maintenance facilities. Table G below shows the minimum requirements for overnight storage for the initial phase.

**Table G** Location for Overnight Storage, 2035, Initial Section, HST Fares 83% of Air

| Maintenance Facility / Station | # of single trainset equivalents |
|---|---|
| San Francisco | 36 |
| Merced | 11 |
| Los Angeles | 20 |
| Anaheim | 23 |
| Heavy Maintenance Facility | 10 |

This snapshot of 2035 operations and trainset needs with fares at 83 percent of air was adapted to handle to handle much less traffic in the first years of service (2020-2022) as explained below. This particular operations plan clearly has much room for improvement from peak period pricing better matching of off-peak trains to the forecast loads, but the levels of activity that are shown provide a sufficient basis for the operating costs needed to handle the forecast level of traffic.

Extrapolation of the 2035 plan to the lower levels of traffic of earlier years was made by changing train miles, train-sets required, and trains operated in ratios related to the expected ridership. Table H shows the evolution of these variables. In the period from 2035 back to 2030, operations decrease 4 percent in line with the small change in passenger traffic. From 2030 back to 2020, ridership is forecast to change more rapidly, at 1.5 percent lower each year due to the growth in population, employment, and personal income in California. Operations are decreased at half that rate, reflecting a greater difficulty of achieving a 1-for-1 change in operating cost in response to larger changes in ridership. Moreover, as a consequence of starting new service in a new market, ridership is assumed to ramp up in a manner observed with high-speed train service introductions overseas. In 2020, the first year of operation, traffic is assumed to be a further 60 percent lower than the 1.5 percent decrease per year from 2030. In the second year, the ramp up amount is 40 percent less; in the third year, 2022, 20 percent less; and only in 2023 reaching 100 percent of its forecast for the year. In each of those start-up years, the savings in operations are only half as large as the drop in ridership, (i.e. 30 percent, 20 percent, and 10 percent lower than the steady state).

**Table H** Key operations parameters Initial Phase, 2035, HST Fares 83% of Air

| Year | Trainset miles per year (millions) | Train operations per day | Trainsets required |
|---|---|---|---|
| 2020 | 19.3 | 121 | 45 |
| 2021 | 27.8 | 174 | 65 |
| 2022 | 35 | 219 | 82 |
| 2023 | 39.2 | 245 | 91 |
| 2024 | 39.5 | 247 | 92 |
| 2025 | 39.8 | 249 | 93 |
| 2026 | 40.1 | 251 | 93 |
| 2027 | 40.4 | 253 | 94 |
| 2028 | 40.7 | 255 | 95 |
| 2029 | 41 | 257 | 96 |
| 2030 | 41.3 | 259 | 96 |
| 2031 | 41.6 | 261 | 97 |
| 2032 | 42 | 263 | 98 |
| 2033 | 42.4 | 265 | 99 |
| 2034 | 42.7 | 268 | 100 |
| 2035 | 43.1 | 270 | 100 |

## Operations, Costing & Cash Flow

The costs of operations and maintenance (O&M) are based on the statistics of the detailed operations plan just described; on California and U.S. costs and labor requirements; on California's specific alignment, stations, and natural environment; and on experience of maintenance frequency and magnitude from high-speed rail systems throughout the world. How each of these was used is explained in the discussion of each component of the operating cost below.

**Figure 8** Operations cost by year - Initial Phase (2009$$)

| | Operating Cost (billions 2009$$) |
|---|---|
| Year | 83% of Air |
| 2017 | $0.02 |
| 2018 | $0.07 |
| 2019 | $0.20 |
| 2020 | $0.68 |
| 2021 | $0.82 |
| 2022 | $0.94 |
| 2023 | $1.01 |
| 2024 | $1.01 |
| 2025 | $1.02 |
| 2026 | $1.02 |
| 2027 | $1.03 |
| 2028 | $1.03 |
| 2029 | $1.04 |
| 2030 | $1.04 |
| 2031 | $1.05 |
| 2032 | $1.05 |
| 2033 | $1.06 |
| 2034 | $1.07 |
| 2035 | $1.07 |

Costs are first incurred in 2017, three years before revenue service begins, in order to test trainsets and systems at increasing speeds and with increasing frequency, and to ensure that all the high-speed train parts work together properly. Key technical staff is hired to help in the testing; they will be the nucleus of the operating and maintenance staff for day-to-day service. In 2019, the full staff needed for the first year's operation is brought on board and the last half of the year sees train operations growing to the levels to be operated with passengers in 2020.

Operating costs strongly ramp up from 2020 to 2023, with 65 percent of the 2030 operations cost incurred in the first year when 37 percent of the passenger traffic is expected, to 97 percent of 2030 when 90 percent of the passenger traffic is expected. In the following years, costs move up at 2/3 the rate of growth in operations, which itself is slightly slower than traffic growth until 2030, and matching traffic growth after 2030.

In each of these years a 5 percent contingency has been added for unknowns, in addition to contingencies on labor for overtime, consumables, and other non-routine expenses.

Calculation of the high-speed train operating cost uses an average cost per employee for the entire operation of $34 per hour (2009 dollars), resulting in an average salary of approximately $71,000, well above the average salary of the highest California metro area[24], and only slightly below the wages of an average employee of the seven largest freight railroads in the US[25]. An additional 32 percent was assumed for total cost to the high-speed train operator, including Social Security, Medicare, and other government payments, health and savings plans, paid vacation, holidays and sick leave resulting in an all-in hourly rate of $45, equivalent to $93,600[26] per year. In addition, a contingency was added to all labor costs of 15 percent for drivers and on-board train crew, and of 10 percent for all other labor.

24 http://www.city-data.com/forum/general-u-s/318570-us-metro-areas-ranked-average-annual.html; need better, more direct reference to US Commerce Dept. Bureau of Economic Analysis data.

25 "Class 1 Railroad Statistics", American Association of Railroads, September 10, 2009 http://www.aar.org/~/media/AAR/Industry%20Info/Statistics%2020090910.ashx

26 Class 1 freight railroad employee total compensation was 38 percent higher than the direct compensation per site above. The difference is primarily due to the higher cost of railroad retirement benefits, a legacy cost that is not expected to apply to HST employees.

Operations costs are estimated at 53 percent of total costs in 2035, and are divided into seven categories as shown in Table I.

**Table I** Initial Section Operating cost by category, 2035, HST fares 83% of Air

| Category | 2009 $$ in millions |
|---|---|
| Operations | |
| Train Driving & Staffing | $101.60 |
| Station Services & Security | $57.40 |
| Sales, Marketing, & Reservations | $64.20 |
| Control Center Operations | $4.10 |
| General /Admin Support | $16.70 |
| Power / Energy – w/ Green surcharge | $321.20 |
| Insurance | $0.00 |
| **Total Operations Cost** | $565.40 |
| Maintenance | $0.00 |
| Maintenance of Way (MOW) Labor | $38.80 |
| MOW Materials & Contracts | $64.00 |
| Maintenance of Trainsets & Vehicles | $351.80 |
| **Total Maintenance Cost** | $454.60 |
| Program Contingency | $51.00 |
| **Total O&M Cost** | **$1,071.00** |

Train driving and staffing includes one driver per train and four crew members per trainset (i.e., eight for a double trainset train). The number of hours worked includes time spent driving and serving on the train, punching in, daily briefings, checking out the train, shut-down at the end of the day, training refreshers, time between trains and similar non-revenue service time. Train driving and staffing accounts for 9 percent of total cost.

Station services and security plus sales, marketing, and reservations include station management, ticketing and customer service representatives, security and crowd control staff, janitorial services, and other specialty services. Three shifts are manned by management and security, and two shifts of 10 hours are assumed for the full staff. Seventeen staff per shift are assumed at nine stations, 25 for the largest five stations. These two categories account for 11 percent of total cost.

Control center operations include a staff of eight persons for three shifts to plan for daily operations, to control train dispatching & power distribution, and to restore normal service in case of disruption.

General/Administration support for operations is calculated at 10 percent of the costs for the above categories amounts, with its own 10 percent labor contingency. Operations general administration plus the control center operations account for 2 percent of total cost.

Power/Energy – w/Green Surcharge is calculated from costs of 17.5 cents per kwh (2009 dollars), 3.5 cents of which cover the cost of using 100 percent renewable energy sources. This average was derived from PG&E's 2008 commercial rates in California. The rate is applied to power consumed by the trains, calculated for the specific California operating alignment and speeds from manufacturer and high-speed train operations information at 0.089 kw/seat mile, and to the much smaller power consumption of stations. Power accounts for 30 percent of the total cost.

Insurance is assumed to be handled by the Authority and the state in the initial phase, through an owner-controlled insurance program (OCIP).

The maintenance costs of way (infrastructure, track, and systems), and vehicles are increasingly convergent, and a growing body of international evidence is being added to the U.S. experience. Costs in this model were drawn primarily from French experience with high-speed operations and maintenance, but are within the range of costs provided by other national railways and transport ministries[27].

Maintenance of way labor is based on ratios per mile of track or right-of-way, resulting in a total of nearly 340 personnel in multiple specialized mechanized teams over two shifts. For track maintenance, more labor and maintenance intensive ballasted track was assumed throughout because the extent of slab track on the California high-speed line has not been decided. Maintenance of way materials is based on percentages of the capital cost per year, varying according to the expected life of the investment, and with an allowance for tools and equipment. In total, maintenance of way accounts for 10 percent of the total cost.

Maintenance of trainsets and other vehicles is based on a materials cost of per-trainset mile-per-year, for routine maintenance, and labor in two shifts spread throughout the facilities around the state. The heavy overhauls are costed with materials at $1.02 per trainset mile per year and additional staff in two shifts, all at the Central Valley heavy maintenance facility. An administrative staff of 120 persons is added as well. In total, 2,000 persons will be working on vehicle maintenance and cleaning. The maintenance of rolling stock category accounts for 33 percent of the total cost.

Finally, a program contingency of 5 percent for unknown costs is added.

The costs are adjusted as explained above for lower levels of riders and activity in prior years, and with the addition of inflation of 3 percent per year, provided by the Authority's financial consultant, results in the year of expenditure (YOE) cash flow shown in Table J below.

## Table J

Initial Phase Operating Results,
83% of air fares, Year of Expenditure $$*

| | 83% of Air - (YOE$$ billions) | | |
|---|---|---|---|
| Year | Revenue | Cost | Surplus (deficit) |
| 2017 | $0.00 | $0.03 | ($0.03) |
| 2018 | $0.00 | $0.09 | ($0.09) |
| 2019 | $0.00 | $0.27 | ($0.27) |
| 2020 | $1.31 | $0.94 | $0.37 |
| 2021 | $2.06 | $1.17 | $0.89 |
| 2022 | $2.87 | $1.37 | $1.49 |
| 2023 | $3.75 | $1.52 | $2.23 |
| 2024 | $3.92 | $1.57 | $2.34 |
| 2025 | $4.10 | $1.63 | $2.47 |
| 2026 | $4.28 | $1.69 | $2.60 |
| 2027 | $4.48 | $1.75 | $2.73 |
| 2028 | $4.68 | $1.81 | $2.87 |
| 2029 | $4.89 | $1.87 | $3.02 |
| 2030 | $5.12 | $1.94 | $3.18 |
| 2031 | $5.31 | $2.01 | $3.31 |
| 2032 | $5.52 | $2.08 | $3.44 |
| 2033 | $5.73 | $2.15 | $3.58 |
| 2034 | $5.96 | $2.23 | $3.72 |
| 2035 | $6.19 | $2.31 | $3.88 |

** Inflation 3% per year from 2009*

27 The maintenance costs are drawn from the professional and academic literature on HST maintenance costs, the experience within the PM team of HST costing in Taiwan, Korea, and the UK, and the CHSRA-hosted seminars by Japanese, French, German, and Spanish government and railway experts on the specifics of their high-speed railways, including maintenance practices and costs. High-speed train systems in Asia and Europe have seen a more-than-forty-year progression of experience in maintaining high-speed tracks, fixed systems, and infrastructure, and similar growth of experience in maintaining high-speed trainsets. Initially the original Japanese Shinkansen and the first French TGV exhibited numerous differences in trainset configuration, staffing, and material costs. However as both systems have expanded, other countries have built their own HST lines, and technical exchanges of best practice have diminished the focus on national systems, the approaches and costs have begun to converge.

## Infrastructure Replacement Funding

In the public transit and U.S. conventional rail sectors, which typically do not generate operating surpluses for the operator (although they create significant public benefits), replacement of capital items is a public sector responsibility and cannot be financed from future cash flow of the operation. High-speed train services, on the other hand, generate positive cash flows around the world, including in the Northeast Corridor[28] . As a result, replacement of trainsets, signaling, overhead power systems, and other relatively short-lived 25-30-year assets, can be financed from the future cash flow that they would produce, akin to corporate bonding of capital improvements in the private markets.

Nonetheless a prudent business plan should provide some reserve for capital replacement as well as for rainy day contingencies, and one approach is to set aside a portion of the cash flow. Replacing the 25-30 year life elements of trainsets, signaling, communications, and catenary would cost roughly twice their YOE acquisition and installation cost, or in the range of $20 billion (2045 dollars).

In Table K, 20 percent of the net cash flow is set aside beginning in 2031, 15 years before replacement of 25 year assets would begin. Interest of 4 percent per year from the accumulated amounts adds to this fund each year. In total, this level of set-aside would provide approximately $16 billion. The remaining 25 percent of the capital could be leveraged from the private sector with the by-then-well-demonstrated cash flow of the operation. Starting a set-aside part-way through the life of the asset increases early cash flows to the operator, and increases the potential for private sector investment. See Table K below.

**Table K** Potential cash flow before and after capital replacement funds at 20 percent of surplus beginning 2031, YOE $$ in billions, initial phase, fare 83% of Air

| Year | Surplus (deficit) *before* capital replacement | Annual deduction for capital replacement | Net surplus (deficit) | Annual deduction for capital replacement | Interest on accumulated amounts | Combined capital replacement fund amount |
|---|---|---|---|---|---|---|
| 2017 | ($0.03) | $0.00 | ($0.03) | | | |
| 2018 | ($0.09) | $0.00 | ($0.09) | | | |
| 2019 | ($0.27) | $0.00 | ($0.27) | | | |
| 2020 | $0.37 | $0.00 | $0.37 | | | |
| 2021 | $0.89 | $0.00 | $0.89 | | | |
| 2022 | $1.49 | $0.00 | $1.49 | | | |
| 2023 | $2.23 | $0.00 | $2.23 | | | |
| 2024 | $2.34 | $0.00 | $2.34 | | | |
| 2025 | $2.47 | $0.00 | $2.47 | | | |
| 2026 | $2.60 | $0.00 | $2.60 | | | |
| 2027 | $2.73 | $0.00 | $2.73 | | | |
| 2028 | $2.87 | $0.00 | $2.87 | | | |
| 2029 | $3.02 | $0.00 | $3.02 | | | |
| 2030 | $3.18 | $0.00 | $3.18 | | | |
| 2031 | $3.31 | $0.66 | $2.65 | $0.66 | $- | $0.66 |
| 2032 | $3.44 | $0.69 | $2.75 | $0.69 | $0.03 | $0.72 |
| 2033 | $3.58 | $0.72 | $2.87 | $0.72 | $0.05 | $0.77 |
| 2034 | $3.72 | $0.74 | $2.98 | $0.74 | $0.08 | $0.83 |
| 2035 | $3.88 | $0.78 | $3.10 | $0.78 | $0.11 | $0.89 |
| 2036 | $4.03 | $0.81 | $3.23 | $0.81 | $0.14 | $0.95 |
| 2037 | $4.20 | $0.84 | $3.36 | $0.84 | $0.18 | $1.02 |
| 2038 | $4.37 | $0.87 | $3.49 | $0.87 | $0.21 | $1.08 |
| 2039 | $4.55 | $0.91 | $3.64 | $0.91 | $0.24 | $1.15 |
| 2040 | $4.73 | $0.95 | $3.78 | $0.95 | $0.28 | $1.23 |
| 2041 | $4.92 | $0.98 | $3.94 | $0.98 | $0.32 | $1.30 |
| 2042 | $5.12 | $1.02 | $4.10 | $1.02 | $0.36 | $1.38 |
| 2043 | $5.33 | $1.07 | $4.26 | $1.07 | $0.40 | $1.46 |
| 2044 | $5.55 | $1.11 | $4.44 | $1.11 | $0.44 | $1.55 |
| 2045 | $5.77 | $1.15 | $4.62 | $1.15 | $0.49 | $1.64 |
| Total | | | | 13.30 | $3.33 | 16.63 |

28 Based on Federal GAO studies, the Pew Charitable Trust calculated $40-50 profit [illegible] positive cash flow [illegible] higher-speed services, after depreciation and other unallocated costs. See http://subsidyscope.com/transportation/amtrak

# Cost of the System

## Cost Estimate Summary

The most recent prior estimate of the capital cost of the San Francisco-to-Anaheim high-speed rail system was expressed in 2008-year dollars at approximately $33.6 billion. The following section will for the first time describe the estimated cost of the project in year-of-expenditure (YOE) dollars, as was required in the application for American Recovery and Reinvestment Act funds, and as compares to the $9 billion in bond funds made available by the passage of Proposition 1A. This way of preparing the estimate provides a more credible view of the cost of the project in the year in which it is expected to be constructed, and the projected cash flow by year.

The updated cost estimate for the San Francisco-to-Anaheim initial high-speed rail system in current year dollars is $35.7 billion. This reflects inflation costs between 2008 and 2009, as well as section cost updates. Adjusting the project cost for YOE dollars brings an updated cost estimate of $42.6 billion. Almost 80 percent of that cost change is attributable to inflation. In other words, only about 20 percent of the estimated cost increase is due to real cost growth due to refinements in estimated unit costs and updated quantities attributable to updated section configurations and to other revisions described below.

The capital costs of the San Francisco-Anaheim portion of the high-speed train system were updated from the 2008 Business Plan estimate to reflect refinements in assumptions, better information, cost escalation from 2008-2009 and projected cost escalation from 2009 to the projected year of expenditure. The cost estimate tables shown below provide details.

- **Table 1** provides a breakdown of estimated infrastructure capital costs, by section, plus estimated rolling stock costs.
- **Table 2** provides estimates of capital costs by year of expenditure by major cost category.
- **Table 3** provides the same information as Table but by section. Table 4 provides program implementation costs including the cost of environmental work and program management.
- **An additional table** shows a cost estimate comparison from 2008 to 2009 dollars and to Year-of-Expenditure Dollars by section and total for the San Francisco to Anaheim portion of the system. A description of the cost increases/decreases from 2008-2009 is provided in the "Regional Section Cost Updates" section below. The footnotes to this third table are important to note:
    - Updated cost estimate in 2009$ includes an estimated $711 million in escalation over 2008$ (2.4%). In real dollar terms, the estimated cost growth from 2008 to 2009 is 7.2%.
    - The San Francisco-San Jose estimate includes an allowance of approximately $1 billion for the CHSTP contribution to the Transbay Terminal cost.
    - Year-of-Expenditure costs were computed by distributing and escalating the 2009$ estimate for each section to the year of planned expenditure. (See accompanying Cash Flow charts for details.)

The methodology and assumptions used in preparing these cost estimates follow these tables.

**TABLE 1**
**CAPITAL COSTS BY SEGMENT**
YEAR OF EXPENDITURE, MILLIONS

| SAN FRANCISCO TO ANAHEIM | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2025 | 2028 | 2031 | 2034 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAN FRANCISCO TO SAN JOSE | | | 41 | 1,416 | 1,760 | 880 | 626 | 324 | 138 | | | | | | | | | | 5,084 |
| SAN JOSE TO MERCED | | | | 71 | 1,071 | 1,156 | 1,131 | 1,166 | 573 | 101 | | | | | | | | | 5,271 |
| MERCED TO FRESNO | | | 97 | 342 | 467 | 503 | 442 | 333 | 28 | | | | | | | | | | 2,212 |
| FRESNO TO BAKERSFIELD | | | 150 | 588 | 681 | 652 | 676 | 629 | 206 | | | | | | | | | | 3,582 |
| BAKERSFIELD TO PALMDALE | | | | | 696 | 835 | 996 | 864 | 532 | | | | | | | | | | 3,922 |
| PLAMDALE TO LOS ANGELES | | | | 244 | 813 | 1,465 | 1,931 | 1,397 | 606 | 49 | | | | | | | | | 6,505 |
| LOS ANGELES TO ANAHEIM | | | 279 | 821 | 1,054 | 899 | 930 | 549 | 192 | 50 | | | | | | | | | 4,775 |
| SYSTEMS AND ELECTRIFICATION | | | | | 47 | 155 | 678 | 1,324 | 1,402 | 820 | 45 | | | | | | | | 4,470 |
| TESTING AND COMMISSIONING | | | | | | | | | 3 | 32 | 53 | 27 | | | | | | | 116 |
| VEHICLES | | | 98 | 144 | 144 | 192 | | 173 | 208 | 592 | 262 | 22 | 44 | 44 | 348 | 348 | 348 | 348 | 3,310 |
| PROGRAM IMPLEMENTATION | 133 | 228 | 473 | 396 | 312 | 370 | 383 | 355 | 376 | 172 | 103 | 47 | | | | | | | 3,347 |
| TOTAL | 133 | 228 | 1,136 | 4,023 | 7,045 | 7,107 | 7,692 | 7,113 | 4,264 | 1,815 | 463 | 96 | 44 | 44 | 348 | 348 | 348 | 348 | 42,594 |

**TABLE 2**
**CAPITAL COSTS BY ITEM**
YEAR OF EXPENDITURE, MILLIONS

| ITEM | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program Implementation | 133 | 228 | 473 | 396 | 312 | 370 | 383 | 355 | 376 | 172 | 103 | 47 | 3,347 |
| Final Design | | | 41 | 314 | 393 | 370 | 185 | 50 | | | | | 1,353 |
| Right-of-Way | | | 527 | 899 | 915 | 245 | 254 | 52 | | | | | 2,892 |
| Environmental Mitigation | | | | | | 328 | 459 | 220 | 64 | | | | 1,070 |
| Rail and Utility Relocations | | | | 314 | 366 | 314 | 177 | | | | | | 1,173 |
| Earthwork | | | | 62 | 674 | 896 | 927 | 636 | 400 | | | | 3,996 |
| Structures | | | | 1,150 | 2,503 | 2,520 | 2,752 | 1,942 | 536 | | | | 11,503 |
| Buildings | | | | 422 | 825 | 824 | 792 | 909 | 565 | 50 | | | 4,387 |
| Grade Separations | | | | 321 | 530 | 546 | 553 | 561 | 124 | | | | 2,634 |
| Track | | | | | 135 | 250 | 532 | 690 | 586 | 150 | | | 2,342 |
| Electrification | | | | | | 107 | 384 | 734 | 761 | 216 | | | 2,195 |
| System Elements | | | | | 47 | 49 | 293 | 990 | 650 | 601 | 45 | | 2,275 |
| Testing and Commissioning | | | | | | | | | 3 | 32 | 53 | 27 | 116 |
| Total Construction | 133 | 228 | 1,040 | 3,879 | 6,901 | 6,916 | 7,692 | 6,940 | 4,056 | 1,223 | 201 | 74 | 39,264 |

**TABLE 3**
**CAPITAL COSTS BY SEGMENT BY ITEM**
YEAR OF EXPENDITURE, MILLIONS

SAN FRANCISCO TO SAN JOSE

| ITEM | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program Implementation | 22 | 37 | 77 | 66 | 61 | 61 | 63 | 55 | 62 | 29 | 17 | 8 | 448 |
| Final Design | | | 41 | 63 | 66 | 46 | 12 | | | | | | 217 |
| Right-of-Way | | | | 192 | 189 | | | | | | | | 291 |
| Environmental Mitigation | | | | | | 76 | 77 | | | | | | 152 |
| Rail and Utility Relocations | | | | 133 | 83 | 57 | | | | | | | 274 |
| Earthwork | | | | 16 | 17 | 9 | 9 | 6 | | | | | 57 |
| Structures | | | | 599 | 723 | 321 | 221 | 115 | 118 | | | | 2,097 |
| Buildings | | | | 422 | 510 | 220 | 156 | 162 | | | | | 1,477 |
| Grade Separations | | | | | 27 | 24 | 14 | 4 | | | | | 69 |
| Track | | | | | 135 | 122 | 36 | 37 | 19 | | | | 351 |
| Electrification | | | | | | 107 | 74 | 64 | | | | | 244 |
| System Elements | | | | | 47 | 49 | 80 | 82 | 54 | | | | 252 |
| Testing and Commissioning | | | | | | | | | 3 | 7 | 3 | | 13 |
| TOTAL | 22 | 37 | 118 | 1,481 | 1,858 | 1,096 | 743 | 497 | 257 | 35 | 20 | 8 | 6,142 |

SAN JOSE TO MERCED

| ITEM | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program Implementation | 25 | 42 | 87 | 73 | 87 | 68 | 70 | 69 | 69 | 32 | 19 | 9 | 616 |
| Final Design | | | | 71 | 86 | 76 | 13 | | | | | | 247 |
| Right-of-Way | | | | | 35 | 36 | 37 | 38 | | | | | 146 |
| Environmental Mitigation | | | | | | 61 | 64 | 68 | | | | | 193 |
| Rail and Utility Relocations | | | | | 37 | 37 | 38 | | | | | | 112 |
| Earthwork | | | | | 282 | 261 | 270 | 212 | 69 | | | | 1,095 |
| Structures | | | | | 804 | 628 | 647 | 563 | 111 | | | | 2,349 |
| Buildings | | | | | | | | 80 | 82 | | | | 162 |
| Grade Separations | | | | | 58 | 60 | 62 | 64 | 64 | | | | 310 |
| Track | | | | | | | | 142 | 244 | 101 | | | 487 |
| Electrification | | | | | | | | 157 | 254 | 95 | | | 506 |
| System Elements | | | | | | | | 126 | 186 | 186 | 40 | | 539 |
| Testing and Commissioning | | | | | | | | | 6 | 13 | 7 | | 26 |
| TOTAL | 25 | 42 | 87 | 144 | 1,129 | 1,224 | 1,201 | 1,514 | 1,063 | 422 | 77 | 18 | 6,943 |

MERCED TO FRESNO

| ITEM | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program Implementation | 10 | 18 | 36 | 30 | 24 | 28 | 29 | 27 | 29 | 13 | 8 | 4 | 257 |
| Final Design | | | | 33 | 35 | 35 | | | | | | | 103 |
| Right-of-Way | | | 97 | 92 | 32 | | | | | | | | 221 |
| Environmental Mitigation | | | | | | 35 | 37 | | | | | | 72 |
| Rail and Utility Relocations | | | | 27 | 28 | 29 | | | | | | | 84 |
| Earthwork | | | | 10 | 11 | 11 | 11 | | | | | | 43 |
| Structures | | | | 118 | 141 | 146 | 71 | | | | | | 476 |
| Buildings | | | | | 156 | 162 | 167 | 173 | | | | | 658 |
| Grade Separations | | | | 62 | 64 | 66 | 68 | 71 | | | | | 331 |
| Track | | | | | | 19 | 88 | 89 | 28 | | | | 225 |
| Electrification | | | | | | | 62 | 77 | 82 | 38 | | | 258 |
| System Elements | | | | | | | 43 | 78 | 81 | 64 | | | 267 |
| Testing and Commissioning | | | | | | | | | | 3 | 7 | 4 | 14 |
| TOTAL | 10 | 18 | 133 | 372 | 491 | 531 | 576 | 515 | 220 | 119 | 15 | 7 | 3,008 |

FRESNO TO BAKERSFIELD

| ITEM | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program Implementation | 17 | 29 | 60 | 50 | 40 | 47 | 48 | 45 | 48 | 22 | 13 | 6 | 424 |
| Final Design | | | | 41 | 42 | 44 | 45 | | | | | | 172 |
| Right-of-Way | | | 150 | 151 | 156 | | | | | | | | 457 |
| Environmental Mitigation | | | | | | | 61 | 63 | | | | | 124 |
| Rail and Utility Relocations | | | | 55 | 55 | 57 | | | | | | | 168 |
| Earthwork | | | | 21 | 21 | 22 | 23 | | | | | | 87 |
| Structures | | | | 196 | 203 | 210 | 218 | 225 | | | | | 1,053 |
| Buildings | | | | | 75 | 78 | 80 | 83 | 86 | | | | 402 |
| Grade Separations | | | | 124 | 128 | 133 | 137 | 142 | | | | | 664 |
| Track | | | | | | 108 | 112 | 116 | 120 | | | | 456 |
| Electrification | | | | | | | 125 | 171 | 188 | 39 | | | 523 |
| System Elements | | | | | | | 102 | 180 | 185 | 91 | | | 536 |
| Testing and Commissioning | | | | | | | | | | 7 | 14 | 7 | 26 |
| TOTAL | 17 | 29 | 210 | 636 | 721 | 899 | 952 | 1,025 | 606 | 156 | 27 | 13 | 5,094 |

BAKERSFIELD TO PALMDALE

| ITEM | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program Implementation | 18 | 31 | 63 | 53 | 42 | 50 | 51 | 48 | 51 | 23 | 14 | 6 | 450 |
| Final Design | | | | | 45 | 46 | 48 | 50 | | | | | 189 |
| Right-of-Way | | | | | 12 | 12 | 13 | 13 | | | | | 50 |
| Environmental Mitigation | | | | | | 47 | 52 | 29 | | | | | 126 |
| Rail and Utility Relocations | | | | | 24 | 24 | 25 | | | | | | 72 |
| Earthwork | | | | | 288 | 298 | 309 | 319 | 331 | | | | 1,545 |
| Structures | | | | | 264 | 342 | 396 | 293 | 106 | | | | 1,402 |
| Buildings | | | | | | | | | | | | | |
| Grade Separations | | | | | 63 | 65 | 67 | 70 | | | | | 265 |
| Track | | | | | | | 86 | 89 | 95 | | | | 271 |
| Electrification | | | | | | | 95 | 99 | 105 | | | | 299 |
| System Elements | | | | | | | 74 | 76 | 79 | 82 | | | 311 |
| Testing and Commissioning | | | | | | | | | | 4 | 8 | 4 | 16 |
| TOTAL | 18 | 31 | 63 | 53 | 738 | 885 | 1,216 | 1,086 | 767 | 109 | 22 | 10 | 4,998 |

PLAMDALE TO LOS ANGELES

| ITEM | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program Implementation | 25 | 43 | 88 | 74 | 56 | 69 | 71 | 66 | 70 | 32 | 19 | 9 | 624 |
| Final Design | | | | 60 | 62 | 65 | 67 | | | | | | 254 |
| Right-of-Way | | | | 164 | 190 | 197 | 204 | | | | | | 775 |
| Environmental Mitigation | | | | | | | 56 | 60 | 64 | | | | 163 |
| Rail and Utility Relocations | | | | | 40 | 41 | 42 | | | | | | 123 |
| Earthwork | | | | | 270 | 280 | 289 | 300 | | | | | 1,139 |
| Structures | | | | | 200 | 647 | 837 | 693 | 201 | | | | 2,576 |
| Buildings | | | | | | 185 | 191 | 196 | 205 | | | | 779 |
| Grade Separations | | | | | 60 | 62 | 63 | 66 | 67 | | | | 267 |
| Track | | | | | | | 88 | 91 | 79 | 49 | | | 307 |
| Electrification | | | | | | | | 98 | 104 | 46 | | | 247 |
| System Elements | | | | | | | 24 | 37 | 64 | 132 | | | 256 |
| Testing and Commissioning | | | | | | | | | | 4 | 6 | 3 | 14 |
| TOTAL | 25 | 43 | 88 | 318 | 871 | 1,534 | 2,026 | 1,596 | 844 | 263 | 28 | 12 | 7,645 |

LOS ANGELES TO ANAHEIM

| ITEM | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program Implementation | 17 | 28 | 61 | 51 | 40 | 47 | 49 | 45 | 46 | 22 | 13 | 6 | 429 |
| Final Design | | | | 56 | 57 | 59 | | | | | | | 171 |
| Right-of-Way | | | 279 | 281 | 291 | | | | | | | | 851 |
| Environmental Mitigation | | | | | | 107 | 111 | | | | | | 219 |
| Rail and Utility Relocations | | | | 98 | 101 | 70 | 72 | | | | | | 341 |
| Earthwork | | | | 14 | 15 | 15 | 16 | | | | | | 61 |
| Structures | | | | 236 | 367 | 329 | 262 | 54 | | | | | 1,249 |
| Buildings | | | | | 84 | 173 | 197 | 213 | 192 | 50 | | | 909 |
| Grade Separations | | | | 136 | 140 | 145 | 150 | 156 | | | | | 728 |
| Track | | | | | | | 121 | 125 | | | | | 246 |
| Electrification | | | | | | | 29 | 71 | 18 | | | | 119 |
| System Elements | | | | | | | | 40 | 42 | 44 | | | 126 |
| Testing and Commissioning | | | | | | | | | | 2 | 2 | 2 | 6 |
| TOTAL | 17 | 29 | 340 | 872 | 1,094 | 846 | 1,008 | 706 | 300 | 118 | 16 | 8 | 6,454 |

## TABLE 4
## PROGRAM IMPLEMENTATION COSTS
YEAR OF EXPENDITURE, MILLIONS

SAN FRANCISCO TO ANAHEIM

| ITEM | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PE/Environmental | 102 | 175 | 290 | 150 | | | | | | | | | 717 |
| Program Management | 29 | 49 | 61 | 95 | 162 | 166 | 163 | 169 | 112 | 77 | 63 | 28 | 1,145 |
| Construction Management | | | 116 | 144 | 149 | 193 | 200 | 165 | 242 | 74 | 31 | | 1,313 |
| Agency Cost | 3 | 4 | 6 | 8 | 11 | 19 | 20 | 21 | 21 | 20 | 19 | 20 | 172 |
| TOTAL | 133 | 228 | 473 | 396 | 312 | 370 | 383 | 355 | 376 | 172 | 103 | 47 | 3,347 |

## Methodology and Assumptions

### INTRODUCTION

The projected capital costs of the California High-Speed Train Project were last updated in preparation of the 2008 Business Plan and reflected preferred alignment as was established by the Programmatic EIR/EIS documents approved by the Authority and FRA in 2005 and 2008. As work on project-specific EIR documents and 15 percent level design is being advanced forward by the Regional Consultants, the capital costs were updated to reflect the current project configuration. This capital cost update will cover the initial phase of the system broken down in the following sections:

- San Francisco to San Jose
- San Jose to Merced
- Merced to Fresno
- Fresno to Bakersfield
- Bakersfield to Palmdale
- Palmdale to Los Angeles
- Los Angeles to Anaheim

### QUANTITIES UPDATE

The estimate is structured to collect quantities on major work items in the following cost categories:

- Track Items
- Earthwork Items
- Structures, Tunnels, Walls
- Grade Separations
- Building Items
- Rail and Utility Relocation
- Right-of-Way Items
- Environmental Mitigation
- Systems Items
- Electrification Items

Each cost category is further divided in to specific cost elements represented in linear, area, volumetric or each units of measure. Regional Consultants have estimated quantities of individual cost elements based on current level of design of each respective segment. Depending on the engineering advancement of each segment, the level of quantity updates varied accordingly.

### UNIT COSTS

The unit costs used in this estimate represent composite costs of each work element derived from detailed estimates of similar work elements constructed as part of major freeway, urban rail transit and water infrastructure projects in California. In January 2009, the unit costs were independently reviewed and updated by the PMT from the 2008 estimate to be more reflective of current conditions and are the basis of this update. Unit cost estimates of 77 different cost items were developed and applied:

- Track - 11 items
- Earthwork - 8 items
- Structures, Tunnels, Walls - 18 items
- Grade Separations - 8 items
- Buildings - 5 items
- Rail and Utility Relocation - 8 items
- Right of Way - 10 items
- Environmental Mitigation - 1 item
- System - 3 items
- Electrification - 2 items
- Other - 3 items

Each of the items is supported by a set of back-up sheets that provide the basis of the unit price, including sources, assumptions, and other adjustments. While it varies from item to item, each item also includes a further breakdown of costs to develop the unit price. For example, a Track Section item would consist of sub-ballast, ballast/ties/fasteners/rail, and drainage elements. The composite unit costs are each based on detailed estimates containing on average 15 specific sub-unit costs from a unit cost data pool of over 1,100 items that ultimately support the capital cost estimate.

### CONTINGENCIES

This estimate update continues to be preliminary in nature, reflecting design levels that vary between concept levels through approaching 15 percent level. Therefore, there

are many work elements that are lacking quantitative definition at this time, thus requiring contingency reserves to account for these costs. In general, 30 percent contingency level has been assigned to all of the cost categories with an exception of the following cost categories that have been assigned 20 percent level of contingencies:

- Track
- Systems Items
- Electrification

This reduction in contingency levels on the cost categories listed above is attributed to more detailed definition of the scope of work and the quantity. In addition, further 5 percent reduction in assumed levels of construction contingencies were taken on earthwork cost categories specifically in the following segments to account for economy of scale and unrestricted access to the alignment in the areas of earthmoving operations:

- San Jose to Merced
- Bakersfield to Palmdale
- Palmdale to Los Angeles

## IMPLEMENTATION COSTS

Engineering, management and administrative costs associated with program implementation have been estimated as following percentages of the total construction costs (including contingencies but excluding right-of-way costs):

- Program Management – 3.5 percent
- Environmental / Preliminary Engineering – 2.5 percent
- Final Design – 4.5 percent
- Construction Management – 4.0 percent
- Agency Costs – 0.5 percent

It should be noted that final design costs are considered to be part of the construction costs and reflected in construction costs subtotal, while the rest of the implementation costs are presented as a separate cost category. There are no contingencies applied on the implementation costs.

## VEHICLES COSTS

The costs of vehicles is established based on publicly available data on recent sales of comparable equipment to other high-speed rail undertakings around the world as well as based on informal consultations with the manufacturers. The costs of vehicle procurement have been divided in to two parts:

- Opening Day demand (assumed 60 trainsets at 2020)
- Optional Orders based on increasing ridership demand (assumed 40 trainsets between 2025 and 2035)

The costs of vehicles required for the Opening Day included an escalation to the year of contract procurement (2011) by 6.61 percent (two years at 3.0 percent and 3.5 percent annual inflation rates). The payment schedule to the vehicle manufacturer reflects anticipated manufacturer annual costs; (i.e., no manufacturer financing is assumed).

The option order price of $34.8 million per trainset for the 40 additional trainsets (the assumed price negotiated at the time the base order is placed) includes a 16 percent escalation factor over 2009 costs.

## INFLATION

### Published Cost Index Data

In review of the Engineering New Record (ENR) published Construction Cost Index (CCI) inflation recorded between August of 2008 and August 2009 are:

CCI (Aug, 2008) = 8362

CCI (Aug, 2009) = 8564

The resulting recorded inflation rate between 2008 and 2009 based on ENR CCI is 2.42 percent.

Also, as a check, California Construction Cost Index (CCCI) was reviewed for the same time period:

CCCI (Aug, 2008) = 5142

CCCI (Aug, 2009) = 5265

The resulting recorded inflation rate between 2008 and 2009 based on CCCI is 2.39 percent. The assumed rate inflation between years 2008 and 2009 in this estimate update is 2.40 percent.

### Forecasted Inflation Rates

Following IMG Team's recommendation to the Authority regarding long-term annual construction cost inflation of 3.50 percent, and taking into account recorded construction inflation rates, the following inflation rates were assumed:

2009 to 2010 – 3.0 percent
2010 and on – 3.5 percent

### YEAR OF EXPENDITURE COSTS

The cost estimate is compiled in 2009 dollars designated as a Base Year. Based on projected ROD/NOD dates for each segment, expected construction durations and generally accepted sequence of major construction activities, the Base Year costs were distributed across implementation years while escalating each allocation from the Base Year dollars to each respective Year of Expenditure dollars. The summation of all distributed and escalated costs for each cost category results in total Year of Expenditure cost. There was no further escalation assigned on the vehicle costs beyond what was described above in Vehicles Costs.

## Section Cost Updates

**Cost Estimate Comparison from 2008 to 2009$ and to YOE$ Estimate by Section**

| | Length (Miles) | 2008 Estimate (2008$ in Millions) | Updated Estimates (2009$ in Millions) | Increase / (Decrease) ($ in Millions) | YOE$ ( in Millions) |
|---|---|---|---|---|---|
| San Francisco-San Jose | 50 | $4,651.0 | $5,282.0 | $631.0 | $6,142.2 |
| San Jose to Merced Wye | 120 | $5,688.0 | $5,666.7 | ($21.3) | $6,943.1 |
| Merced-Bakersfield | 175 | $6,916.8 | $6,754.9 | ($161.9) | $8,100.3 |
| Bakersfield-Palmdale | 85 | $4,280.3 | $4,089.9 | ($190.4) | $4,997.9 |
| Palmdale-Los Angeles | 60 | $5,942.7 | $6,278.1 | $335.4 | $7,646.3 |
| Los Angeles-Anaheim | 30 | $2,156.0 | $4,628.0 | $2,472.0 | $5,454.3 |
| **Total w/o Vehicles** | **520** | **$29,634.8** | **$32,699.6** | **$3,064.8** | **$39,284.1** |
| **Vehicles** | | **$4,000.0** | **$3,000.0** | **($1,000.0)** | **$3,310.1** |
| **Total SF-Anaheim HST System Cost** | | **$33,634.8** | **$35,699.6** | **$2,064.8** | **$42,594.2** |

**Notes:**

1. Updated cost estimate in 2009$ includes an estimated $711 million in escalation over 2008$ (2.4%). In real dollar terms, the estimated cost growth from 2008 to 2009 is 7.2%.
2. The San Francisco-San Jose estimate includes an allowance of approximately $1 billion for the CHSTP contribution to the Transbay Terminal cost.
3. The 2008 Vehicles cost was based on the fleet size to handle the 50% airfare HST fare. The 2009 estimate is based on a fleet size needed to handle 83% airfare HST fare.
4. Year-of-Expenditure costs were computed by distributing and escalating the 2009$ estimate for each section to the year of planned expenditure. (See accompanying Cash Flow chart for details.)

The Cost Comparison Table on the previous page lists the estimated increases and decreases in costs from the 2008 estimate to the current estimate. A brief summary of what was behind these changes in cost estimate by Section is provided below.

### San Francisco – San Jose

The net cost increase in this segment is $631 million principally attributed to the following items:

- higher trackwork costs to reflect an increase in composite unit costs ($160 million)
- increase in aerial structure quantity and increase in projected unit costs ($1,144 million) (Note: this cost is more than offset by a reduction in the number of grade separations ($1,350 million decrease)
- increase in right-of-way acquisition cost, principally for the maintenance facility ($337 million)
- increase in building costs due to moving the cost of Diridon Station into the San Francisco-to-San Jose section and retrofitting of 3 Caltrain stations ($211 million)
- increase in rail and utility relocation costs due to relocation/removal of existing tracks and major utility relocation within the corridor ($219 million)
- increase in electrification costs due to adjusted composite unit costs ($36 million)
- decrease in earthwork volumes ($125 million decrease)

### San Jose – Merced via Pacheco Pass (Preferred Alternative, additional work underway on Program EIR)

The capital cost of this segment has decreased in aggregate by $21 million compared to 2008. This decrease is attributed to the following:

- Moving cost of Diridon Station and Light Maintenance Facility out of San Jose-to-Merced section and into San Francisco-to-San Jose section
- Update of right-of-way quantities
- Update of unit costs;

### Merced – Bakersfield

The capital cost of this segment has decreased in aggregate by $162 million compared to 2008. This decrease is attributed to the update of unit costs, specifically reduction in projected costs of undeveloped land.

### Bakersfield – Palmdale

The capital cost of this segment has decreased in aggregate by $190 million compared to 2008. This decrease is attributed to the update of unit costs, specifically reduction in projected costs of undeveloped land.

### Palmdale – Los Angeles

The total cost increase in this segment is $336 million, principally attributed to the increases in the composite unit costs for trackwork and structures offset by reduction in grade separation costs and shifting the LA Union Station cost to the Los Angeles-to-Anaheim section.

### Los Angeles – Anaheim

The total cost increase in this segment is $2,446 million due to major changes in scope as following:

- increase in single track construction to accommodate "4+2" corridor configuration ($133 million), also combined with increases in composite unit costs
- increase in earthwork costs reflecting additional cost of urban demolition associated with additional right-of-way acquisitions in support of "4+2" track configuration ($51 million)

- increase in aerial structure quantities and addition of twin bore and cut and cover tunnels, also compound by increase in composite unit costs ($1,095 million)
- increase in building costs associated with addition of LA Union Station (LAUS) to this segment, and additional costs for traffic mitigation and site development at LAUS, Norwalk, and Anaheim stations ($507 million)
- increase in rail and utility relocation costs due to relocation/removal of existing tracks and high voltage power line relocations within the corridor ($280 million)
- increase in cost of anticipated environmental mitigation due to overall increase of construction costs ($161 million)
- increase in right-of-way costs to account for land acquisitions in support of "4+2" corridor configuration and maintenance facility site ($334 million)

These increases are offset by decreases in grade separation costs due to reclassification of grade separation types from urban to suburban types ($120 million)

# Paying for the System

## Financial Plan Overview

California has a unique opportunity in that it is armed with a $9 billion, voter-approved, general obligation bond to provide critical state proceeds for high-speed rail construction. The following financial plan will outline each of the various funding sources with details on the Authority's financial assumptions, including the $9 billion from state funds available through Proposition 1A; approximately $17-$19 billion in federal funding that includes, in part, money from the American Recovery and Reinvestment Act; $4-$5 billion in local support and through public-private partnerships (P3s) such as transit-oriented development, parking concessions and naming rights opportunities; and $10-$12 billion in P3 funding. As outlined in previous sections, the cost of that system in this financial plan is adjusted for the year when costs will actually be expended, allowing the Authority to have a more accurate projection of the overall costs in the year funds will be needed.

California faces a unique opportunity to create one of the first high-speed rail systems in the country. The state is armed with a $9 billion, voter-approved, general obligation bond to provide critical state proceeds for high-speed rail construction. In addition, the $8 billion appropriated by the American Recovery and Reinvestment Act (ARRA) dramatically changed the funding landscape for high-speed and intercity passenger rail in the United States. California's high-speed rail financial plan focuses on four primary funding sources for the initial San Francisco-to-Anaheim portion of the project: state, federal, local and private.

The following financial plan will outline each of the various funding sources with details on the Authority's financial assumptions. This includes $9 billion from state funds, available through the Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century, approved by California voters as Proposition 1A in 2008. The Authority is also seeking approximately $17-$19 billion in federal funding. Part of the overall federal input includes the American Recovery and Reinvestment Act (ARRA) based on the Authority's recently submitted ARRA application totaling $4.7 billion for four different construction sections and additional environmental and engineering funds. The Authority is targeting $4-$5 billion in local support and through public-private partnerships (P3s) such as transit-oriented development, parking concessions and naming rights opportunities.

As demonstrated in the previous section on ridership and revenue, the initial San Francisco-to-Anaheim portion of the project is expected to generate significant operating surpluses even after accounting for operations and maintenance costs and renewal and replacement reserves. This dedicated and significant revenue stream after full San Francisco-to-Anaheim operation begins will provide the Authority with an opportunity to seek innovative P3s to provide capital funding to help complete the system. The Authority is targeting $10-$12 billion in P3 funding.

As outlined in previous sections, the cost of that system, adjusted for the year when projects will actually be constructed (year of expenditure dollars or YOE), and taking into account project changes outlined in the previous chapter, is estimated by the Authority to be $42.6 billion. This allows the Authority to have a more accurate projection of the overall costs in the year funds will be needed.

| Funding Sources Summary (YOE $ M) | |
|---|---|
| Federal grants | $17,009 - $19,000 |
| State grants | $9,000 |
| Local grants | $4,000 - $5,000 |
| Private funding | $10,000 - $12,000 |
| Total | $42,600 |

A detailed look at the Authority's Financial Plan for building the high-speed train project follows.

## State Funding

### Introduction

The State of California historically has played a major role in the development of passenger rail service in California. Consistent with this role, the Financial Plan for the San Francisco-to-Anaheim portion of the California High-Speed Rail Project anticipates $9 billion in state funds for its development. The source of state support has come from the Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century (the Bond Act)[29], which voters approved in November 2008. The passage of the Bond Act demonstrated California's financial and political commitment for the high-speed train, which are critical in generating necessary financial support from federal, local and private sources.

### Bond Measure

The Bond Act, Proposition 1A on the November 4, 2008 California ballot, authorized the state to issue $9.95 billion of general obligation bonds, $9 billion of which would be used to develop a high-speed train system. The remaining $950 million raised under the Bond Act will be allocated for capital improvements to commuter and intercity rail lines, which will connect to the high-speed train system.

### Bond Provisions Summary

As specified in the Bond Act, bond proceeds may be used for preliminary engineering, right-of-way acquisition, and the construction of tracks, structures, power systems and stations. Additionally, rolling stock and related equipment, as well as other capital-related facilities and equipment can be purchased with these funds. However, proceeds of bonds described above shall not be used for more than 50 percent of the total cost of construction of each corridor or usable segment thereof of the high-speed train system. In addition, the Bond Act establishes caps on the amount of funds that can be expended for preliminary engineering, planning and environmental studies to 10 percent of proceeds and not more than 2.5 percent on administrative expenses (subject to increase by the Legislature, up to 5 percent). The bill requires that, among other considerations, the Authority gives priority in selecting corridors that are expected to require the least amount of bond funds as a percentage of total cost of construction. Additional details on the Bond Act can be found at the link below.

29 http://www.cahighspeedrail.ca.gov/images/chsr/20081118153013_Source%20Document_20[illegible]

### Plan to Leverage the State's dollars

The Bond Act passage represents a significant and important investment in high-speed rail development as California voters approved the measure. The Authority plans to leverage these critical bond proceeds to match federal grant funds, local investment as well as potential private sector interest. The Authority's ARRA grant application, for example, proposes a 50 percent match to federal grant funds, which could include state, local and other funding as matching sources. The state was able to propose this dollar-for-dollar match offer because of the existence of the Bond Act funds, and the Authority believes this offer makes California's application more competitive than those of other states to win a significant portion of the ARRA funds.

ARRA Funding Dollar-for-Dollar Match

| Project | Total Capital Costs (YOE$ M) | Requested ARRA Funds | Matching State Funds |
|---|---|---|---|
| Initial Phase PE/NEPA/CEQA | $388 | $194 | $194 |
| Subsequent Sections NEPA/CEQA | $120 | $60 | $60 |
| Altamont Corridor NEPA/CEQA | $45 | $22.5 | $22.5 |
| Total PE/NEPA/CEQA Projects | $553 | $276.5 | $276.5 |
| **Project** | **Total Capital Costs (YOE$ M)** | **Requested ARRA Funds** | **Matching State, Local, Private Funds** |
| SF-San Jose Design-Build | $1,960 | $980 | $980* |
| Merced-Fresno Design-Build | $932 | $466 | $466 |
| Fresno-Bakersfield Design-Build | $1,639 | $819.5 | $819.5 |
| LA-Anaheim Design-Build | $4,375 | $2,187.5 | $2,187.5 |
| Total Design-Build Projects | $8,906 | $4,453 | $4,453 |
| Total - All Projects | $9,459 | $4,730 | $4,730 |

*Includes $336 M in committed local funding

## Federal Funding

### Introduction

Federal support, both financial and regulatory, is a key component to the success of California's high-speed train project. The financing plan for the San Francisco-to-Anaheim system targets approximately $17-$19 billion from federal sources. Although a portion of this funding may come from existing federal transportation programs, including the Passenger Rail Investment and Improvement Act (PRIIA), the creation of new programs designed specifically to advance high-speed rail projects will likely be necessary to achieve this level of support.

This section will explain the basis for the targeted $17-19 billion from federal sources. Federal funding sources will likely be drawn upon during the early stages of the project, as the majority of private sector support is likely to occur only after much of the targeted federal funding has been secured. The development of specific federal high-speed train programs or the commitment of federal funds for California's high-speed train project, in particular, are key signals that would encourage private participation in the project.

Historically, federal funds have supported approximately 50 to 80 percent of many major transportation projects including highway, transit, and aviation sector related projects. In the early years of transit funding, developing transit programs was a federal priority and funding for such projects was approximately 80 percent federal. Although the scale of California's high-

speed train project is much larger than a typical major transportation project, there is precedent for substantial federal support for large and nationally significant transportation projects. In addition, the authorizing grant program established in Section 501 of PRIIA sets the statutory maximum federal contribution at 80 percent.

### ARRA Projects and Funding Plan

A critical and immediate piece of federal funding was granted during the American Recovery and Reinvestment Act (ARRA)[30], which appropriated $8 billion to high-speed rail, intercity rail and congestion grants. This opened the door to fund major corridor development as well as environmental and planning programs for high-speed and intercity rail corridors throughout the country.

The Authority has requested ARRA funding assistance for a subset of independent utility projects that will help to further the Authority's longer-term goal of establishing service from San Francisco-to-Anaheim. All of these projects were under the FRA's "Track 2" umbrella, which allows for construction to be completed by 2017. This has a longer time frame than the "stimulus" portions of this provision ("Track 1") to allow states the necessary lead and construction time to successfully complete these projects.

The costs for the Authority's "Track 2" sections totals $9.459 billion in YOE dollars. The Authority requested a 50 percent federal funding share for each of these projects and providing a 50 percent match with state, local or other sources. As outlined in the table on the previous page , for the $553 million in PE/NEPA/CEQA projects, the Authority plans to match $276.5 million in federal funds with an equal amount of state bond funds. For the $8.906 billion in design-build projects, the Authority proposes to match $4.453 billion in federal funds with local and private funding as part of the $4.453 billion match in addition to state bond proceeds.

As explained in the previous chapters, successful receipt of federal funding would result in the completion of much of the required environmental and engineering work necessary for the initial San Francisco-to-Anaheim project as well as the construction of a substantial portion of the underlying infrastructure. The federal ARRA funding is consistent with the Authority's plan of funding the initial project with a combination of federal, state, local, and private funding.

### Existing Federal Programs and Available Funding

The American Recovery and Reinvestment Act (ARRA) dramatically changed the landscape for high-speed rail funding in the United States. Prior to ARRA's passage, funding for high-speed trains was limited to an authorized $1.5 billion in PRIIA. ARRA appropriated $8 billion to three different grant programs within PRIIA including the high-speed rail program. In addition to the authorizing grant mechanism under PRIIA, relevant federal programs that could provide support to high-speed trains include the Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA), the Railroad Rehabilitation and Improvement Financing Program (RRIF), and Private Activity Bonds (PABs).

## Key Grant Program Mechanism

### Passenger Rail Investment and Improvement Act (PRIIA or P.L 110-432)

Signed into law on October 16, 2008, PRIIA primarily authorizes appropriations for Amtrak over the next five years. However, the law also includes language that created the first grant mechanism for high-speed passenger rail and it authorized $1.5 billion in grants over five years for high-speed rail corridor development to states or Amtrak to finance the construction and equipment for California and 10 other federally designated high-speed rail corridors under Title 5 (PRIIA Section 501). The federal

30 See the FRA's "Interim Program Guidance" at www.fra.dot.gov/us content/2243 for additional details.

share for these projects is capped at 80 percent with the Secretary of Transportation awarding these grants on a competitive basis based on economic performance, expected ridership, and other factors. The ARRA appropriation of $8 billion used the grant mechanism established under Section 501. PRIIA's Section 501 represents the first federal grant program dedicated to high-speed rail funding.

## Federal High-Speed Rail Appropriations

ARRA appropriated $8 billion to three different grant vehicles authorized under PRIIA (described below). This represented the first appropriated funds to high-speed rail development for the country. The maximum federal contribution outlined in the statute could be a maximum of 100 percent. However, the Authority's board voted to propose a dollar-for-dollar match with federal grant funds. The Authority submitted a grant application for "Track 2" funds under the High-Speed and Intercity Passenger Rail program totaling $4.7 billion. As mentioned above, the Authority selected projects based on the ARRA funding requirements for its ARRA application.

INNOVATIVE FINANCE AND LOAN PROGRAMS

### Annual Appropriations

In addition to ARRA, the President's January FY2010 Budget proposed an additional $1 billion per year over a five-year period for investment in high-speed trains nationally. The President's proposal demonstrates significant support for their development. The House and Senate have taken the President's proposed $1 billion annually and recommended $4 billion in the House transportation bill and $1.2 billion in the Senate. The House bill includes the possibility of shifting $2 billion (of the $4 billion) to a National Infrastructure Bank should one be created. These proposals have passed their respective chambers and are awaiting Conference Committee meetings.

## Innovative Finance and Loan Programs

The Authority's plan of finance includes grant funding for the major federal funding components and innovative finance mechanisms for the P3 piece. The federal government currently sponsors a few different innovative finance programs that could be useful to the Authority as it seeks P3 funding for the project. The following innovative finance and loan programs represent mechanisms that the Authority or a P3 concessionaire may employ to reduce the cost of borrowing.

### Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA)

TIFIA is an established federal credit assistance program for eligible transportation projects of national or regional significance. These include transit and passenger rail facilities, such as the California project. Under TIFIA, the U.S. Department of Transportation (DOT) can provide three forms of credit assistance to eligible projects. These means of assistance include secured (or direct) loans, loan guarantees, and standby lines of credit.

The fundamental goal of TIFIA is to leverage federal funds to attract substantial private and other non-federal co-investment into projects that provide critical improvements to U.S. surface transportation. Principal amounts of credit assistance provided by TIFIA are limited to 33 percent of eligible project costs. Additionally, interest rates for TIFIA loans generally reflect the government's borrowing costs, and the terms of repayment are generally favorable to project sponsors.

The Authority's Financial Plan envisions the use of the TIFIA loan program as subordinate debt for the P3 portion of the program funding. Further details on assumptions and possible

uses of TIFA are provided in further detail in the P3 section of this chapter.

### Railroad Rehabilitation and Improvement Financing Program (RRIF)

The RRIF program is a revolving loan and loan guarantee program that is administered by the Federal Railroad Administration (FRA). It is legislatively enabled to issue up to $35 billion in loans. The program originally was established by the Transportation Equity Act for the 21st Century (TEA-21), and was amended by the Safe Accountable, Flexible and Efficient Transportation Act: a Legacy for Users (SAFETEA-LU).

Funding from RRIF may be used to acquire, improve or rehabilitate intermodal or rail equipment or facilities, including track, components of track, bridges, yards, buildings, and shops. Funds also may refinance outstanding debt incurred for those purposes listed previously, or may be allocated to develop or establish new intermodal railroad facilities.

Attractive interest rates, similar to those available under TIFIA, also exist under RRIF. This program is able to fund up to 100 percent of a project's costs, allows for a five-year grace period, and requires the payment of an up-front risk premium.

As RRIF is typically senior debt, a RRIF loan could be combined with a TIFIA subordinate loan. It is important to note that these sources are loans and will need to be repaid. The Authority's Financial Plan includes scenarios that assume a possible combination of RRIF and TIFIA loans as both senior and subordinated debt under the P3 funding package. The maximum TIFIA contribution is 33 percent of total project costs.

### Private Activity Bonds (PABs)

Private Activity Bonds are tax-exempt bonds that are issued by the state or local government on behalf of a private entity. Their purpose is to facilitate private investment for projects that generate public benefit. PABs allow for the private sector to borrow at tax-exempt rates resulting in lower overall financing costs. Currently any PABs issued for high-speed trains would be subject to a volume cap of the respective state; however, a new category of exempt facilities was created under SAFETEA-LU that allows projects receiving Title 23, and under certain conditions Title 49 funds, to qualify for the $15 billion in transportation PABs[31]. The Secretary of Transportation and the US DOT are responsible for the allocation of these PABs.

PABs are highly attractive to private investors in conjunction with a public-private partnership (P3) program that includes equity investment, design-build, and operations involvement and could be used in conjunction with TIFIA/RRIF. For instance PABs were recently used in the financing of the $1.9 billion Capital Beltway project in Northern Virginia, one of the first variable toll rate congestion pricing projects in the U.S.

Some of the Authority's Financial Plan scenarios for the P3 funding portion includes the use of PABs as senior debt coupled with a subordinated TIFIA structure.

## Changes Needed to Existing Programs and New Legislation

New funding sources, specifically for high speed rail, along with the expansion of existing transit programs, will need to be created in order to provide adequate support for the high-speed train. Project proponents argue that a focus on investing in America's overall transportation system, as opposed to individual modal investments, would encourage more efficient allocation of transportation dollars and likely increase the proportion of funding provided for rail projects. As mentioned above short term funding for high-speed trains is

31 Specifically, the new category includes: 1) any surface transportation project receiving Title 23 funds, 2) a project for an [illegible] national entity authorized under federal or state law is responsible and which receives Title 23 funds, and 3) facilities for the [illegible] which receives federal assistance under Title 23 or Title 49. Title 23 and 49 are U.S. Code governing federal funding for highways and [illegible]

anticipated through the annual transportation appropriations process as a new transportation authorization has yet to come to the floor. The surface transportation reauthorization provides the opportunity for the Authority and other states developing high-speed rail to seek a long-term dedicated funding source. In fact, the Authority has already begun to advocate for dedicated federal funding for high-speed trains, working with members of California's congressional delegation.

Expansion of existing federal funding programs, as well as significant new initiatives, will be required to support California's high-speed train at the levels assumed in this financing plan. Modification of existing federal financing terms and restrictions also would make the project more attractive to private investors, thereby facilitating achievement of the targeted private sector funding levels, as well.

## Transportation Reauthorization: Re-Authorization of Safe Accountable, Flexible and Efficient Transportation Act: A Legacy for Users (SAFETEA-LU)

SAFETEA-LU addresses many of the challenges that face today's transportation system, including improving safety, reducing traffic congestion, improving efficiency in freight movement, increasing inter-modal connectivity, and protecting the environment, as well as laying the groundwork for addressing future challenges. It promotes more efficient and effective federal surface transportation programs by focusing on transportation issues of national significance, while giving state and local transportation decision makers more flexibility for solving transportation problems in their communities.

The reauthorization of this legislation sets key transportation funding priorities. The current SAFETEA-LU expired on September 2009. Reauthorization, however, is expected to take place over the next18 months. This reauthorization process is seen as a vehicle for modifications to existing programs that could support high-speed trains. Specific modifications that would benefit high-speed trains include:

- Create a dedicated funding mechanism similar to the highway trust fund,
- Extend terms for TIFIA and RRIF debt to more closely match the useful lives of the infrastructure,
- Reduce or modify the RRIF credit risk premium,
- Create a new-mode contingent liability program to mitigate greenfield ridership risks,
- Explicitly enable high-speed projects to use the $15 billion in PABs authorized under SAFETEA-LU for transportation projects.

Chairman Oberstar's proposal for transportation reauthorization attempts to address the funding challenge high-speed rail faces on the federal front and includes a proposed authorization of $50 billion.

## New Legislation

While legislation introduced to date addresses many of the needs for high-speed trains, a key financing mechanism that will help support private sector investment will be in the creation of a type of contingent liability program that allows a potential private sector operator to share some of the start-up risks associated with ridership. In Europe and Asia, rail entities have developed extensive experience with intercity and high-speed rail ridership demand forecasting. However, the United States does not have an established rail culture nor experience with such forecasts. As such, the level of assurance a private investor, credit rating agencies and bond markets may have in ridership projections may make P3 financing a challenge. The Authority is currently investigating ridership risk sharing structures used in greenfield transportation infrastructure projects as well as considering proceeding with an "investment grade" ridership forecast.

## Local Support

### Introduction

Local support will provide an important funding source for high-speed rail development. Targeted local support for the project can be divided into two main parts: 1) cost sharing or local government support, and 2) private participation in station or area development. The Authority's Financing Plan for the Anaheim to San Francisco system targets $4-$5 billion in local financial support. Local support is estimated to be between $2-$3 billion and is based on population and possible contribution levels from communities across the state. In addition, the Authority is targeting opportunities such as naming rights and P3 development around stations totaling another $1-$2 billion. As such, the Authority is estimated between $4-$5 billion in local support for the project.

The Authority plans to develop plans to solicit and develop a process for formalizing local support over the next several months.

## Cost Sharing with Local Agencies and Governments

The Authority has been engaged in preliminary discussions with transportation authorities in several areas of the state and identified a number of projects where costs might be shared between the Authority and local agencies. To date, the Authority has focused on those projects that would benefit commuter rail service in addition to high-speed rail. The San Francisco to San Jose and Los Angeles to Anaheim corridors are two examples where the Authority believes significant cost sharing opportunities may exist.

As mentioned above, the Authority has targeted approximately $2-$3 billion in local funding support from local communities across the state. This estimate was calculated using an estimate of self-help county contributions to transit as a proxy. However, self-help counties were merely used as a guide to estimate possible contributions that could come in numerous forms, including from Transit Oriented Development, Benefit Assessment Districts (or Community Facilities Districts), Tax Increment Financing, general funds, etc. As mentioned above, the Authority is currently working on plans to develop a methodology to work with local governments and agencies to provide support for project development.

During the ARRA funding process, many communities along the alignment pledged support for the project. However, the Authority understands that competing requests for limited local and regional transportation funds make it difficult for other local communities to set funding priorities at this time, especially given the locals' needs to retain contingencies for potential cost increases for existing local projects. The Authority expects that as the project timeline, requirements, and other funding are refined, local funding commitments will be made. As discussed below, cost sharing with local agencies and locally generated revenues from transit-oriented development will be negotiated over time.

## Locally Generated Revenues from Transit-oriented Development and Community Facilities Districts

One way for local governments to realize significant local revenues from real estate appreciation along the alignment is through Transit-Oriented Development (TOD). TOD would allow local governments to benefit from the development of high-speed trains with increased real estate tax revenues from increased density without burdening the balance sheets of local governments. The Financial Plan presumes that the Authority would work closely with each local agency to explore and adopt TOD agreements. As past experience has shown, TODs must be carefully crafted to local conditions and revenue benefits are often realized after the project is completed

In addition to TOD, the implementation of publicly established benefit assessment districts and the Mello Roos districts near

a transit or rail facility are alternative ways to raise development-related revenues that can be financed. However, the formation of benefit assessment districts and Mello Roos districts require local approval, and cannot be implemented by the Authority directly. In addition, a benefit assessment district or Mello Roos district must be a relatively large geographic area in order to provide a significant contribution to the project's capital costs from any given local bond issue or program. Furthermore, as these types of financing vehicles are real estate development driven, ratings agencies and investors may view them as speculative, thereby limiting the amount of up-front bond funding that can be generated for early-stage development of high-speed rail. Regardless of the challenges associated with assessment districts, successful transportation projects have been implemented using benefit assessment districts either immediately surrounding a transit station or along an entire alignment as was seen in the Dulles Metrorail extension in Virginia.

## Commercial Concessions at CHSR Stations

Commercial concessions at stations are important tools to realize additional locally generated revenues. These concessions include retail stores, advertising, parking, and other commercial revenues. The Financial Plan presumes that the Authority would work closely with appropriate local agencies to explore and adopt station commercial concessions before stations are built. These types of revenues and related agreements may be viewed by the market as speculative, thereby limiting the amount of upfront funding that can be generated for early-stage development of high-speed rail.

## Cooperative Funding Arrangements with Local Transportation Authorities

California law allows "self-help" counties to elect to dedicate an increase in local sales tax for local transportation projects. The current and future self-help county sales tax revenue streams can be used on a "pay as you go" basis or can be pledged as a source of payment for sales tax revenue bonds. California's self-help counties have collectively issued billions of dollars of sales tax revenue bonds.

At least 20 California counties have passed sales tax measures for transportation for specific time periods ranging for 10 years to 30 years. Los Angeles County has a permanent 1 percent sales tax increment dedicated toward transportation projects. In addition, Los Angeles County successfully passed an additional 0.50 percent sales tax (Measure R) for transportation on the November 2008 ballot. The self-help counties have specific expenditure plans about how the sales tax revenues must be spent, which must be consistent with the measures approved by local voters.

Each self-help county expenditure plan is different and reflects local transportation policy and goals. The self-help counties along the high-speed rail alignment may have the ability to pledge a portion of their sales tax for project capital costs. The Authority has begun preliminary work to negotiate with the relevant local transportation authorities to explore their interest in providing financial support in order to facilitate or expedite implementation of the project in their respective regions.

The Authority already has worked closely with several local transportation authorities on joint development challenges. For example, the Orange County Transportation Authority (OCTA) signed a memorandum of understanding with the Authority in 2007 that calls for OCTA to contribute $7 million toward development costs for High-Speed Rail in Orange County between Anaheim and the Los Angeles county line.

**Local Cooperation: OCTA Example**

OCTA is committed to dramatically increasing transit options in Orange County. OCTA already uses Measure M sales tax revenues to fund transit projects throughout the county. In November 2006, Orange County residents voted to extend Measure M until 2046. Although OCTA has covenanted to spend some of its Measure M sales tax revenues on specified freeway projects, OCTA also has a wide degree of flexibility in spending remaining Measure M sales tax revenues on transit projects, including rail. Additionally, OCTA and the City of Anaheim have formed a joint powers authority, the Anaheim Regional Transportation Intermodal Center (ARTIC) that is pursuing a public-private partnership for development of an intermodal transportation center that can accommodate freeway, bus, Metrolink, Amtrak, and high-speed rail access.

## Private Funding / Public-Private Partnerships

### Introduction

One of the ways the Authority would like to leverage public funds for this project is through pursuing public-private partnerships. High-speed rail, unlike most transit services, is expected to generate significant operating surpluses. These operating surpluses are the basis for the Authority's plans to engage private sector support. Private funding through public-private partnership arrangements is an increasingly accepted method to support the development of infrastructure projects. Based on this premise, the Authority's Financial Plan is targeting $10 to $12 billion (in year of expenditure dollars) from potential private sources for the San Francisco-to-Anaheim segment. This investment is primarily backed by the high-speed rail's projected future operating surpluses as well as some type of revenue guarantee and is based on a level of risk and capital markets terms that the team believes are appropriate for this type of project. To gain a better understanding of private interest in the project, the Authority issued a Request for Expressions of Interest (RFEI) in the Spring of 2008. Since that time, the Authority has continued to reach out to private industry leaders with experience in High Speed Rail and other large infrastructure projects. Results of the RFEI have shown that private sector interest is strong and diverse; however, public support, both financial and political, is needed to generate private funding commitments.

## Background on Private Investment in Infrastructure

Historically, major transportation infrastructure projects in the United States have been funded primarily with federal funds (as much as 80 percent), with state funding comprising the remaining share. This paradigm is based substantially on the construction of the interstate highway system in the 1950s. Since that time, the increasing cost of public works projects has not been matched by the public funds available to pay for them. For example, federal shares of major infrastructure projects have decreased to approximately 30 percent for some programs, and states have had to make tough decisions to prioritize the expenditure of their funds. Increasingly, U.S. project sponsors have followed international trends and are turning to private funding sources to develop certain projects.

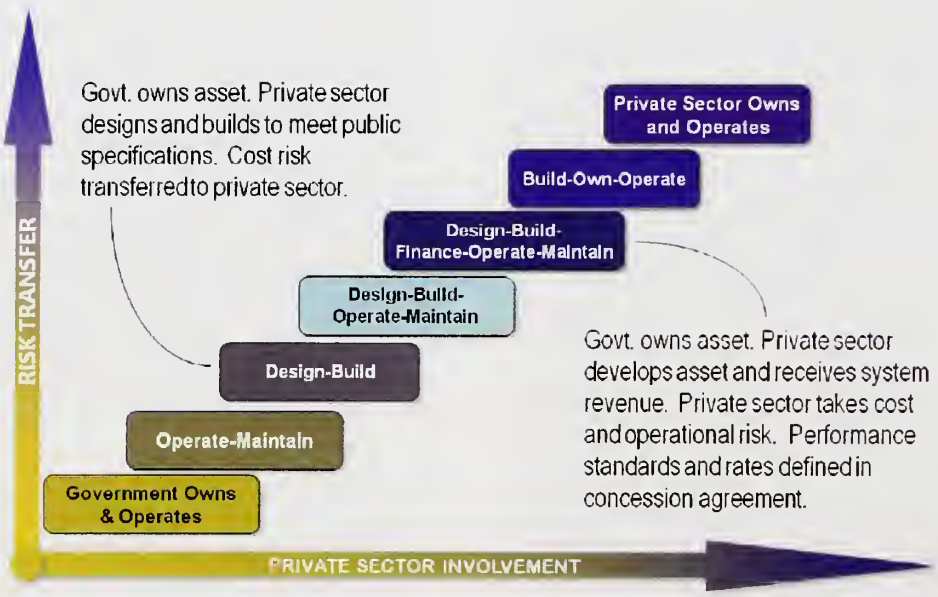
This trend has been intensified by the active interest of private investors, partially driven by pension funds, in the infrastructure sector. These investors have been attracted to long-term assets with stable cash flows. These tend to be 'brownfield' or developed projects with a revenue history. In the United States

toll roads have been the major focus. Some key examples of private investment in toll roads are the long-term lease of the Chicago Skyway and the Comprehensive Development Agreement (CDA) toll roads in Texas. However, the assets of private equity funds interested in infrastructure investment far exceed the value of stable, brownfield investments available, which has encouraged these firms to invest in non-toll road infrastructure. In addition, given the large capital expenditures contemplated in many infrastructure projects, engineering and equipment firms have been willing to invest in projects to participate in project-related contracts.

The level and timing of private participation is dependent on the perceived risks associated with private investment. The main risks associated with the high-speed train project are environmental, regulatory, legislative, construction, technological, ridership and operational. For a P3 arrangement to be successful, these risks need to be shared between the public and private sectors. In general, costs are lower when a risk is assigned to the party with the best ability to manage that specific risk. The private sector will expect to be compensated for any risks that it assumes. Therefore, the more risk that the public sector chooses to address, the higher the level of upfront private investment that can be attracted to a given project. In some cases, for example, with environmental and regulatory risks, the public sector may need to significantly mitigate the risk before the private sector will invest.

## Alternative Delivery Approaches

The Authority is considering a wide variety of project delivery approaches to optimize the allocation of risks. These approaches can range from less private participation to more private sector involvement as depicted in the figure below. Each approach is associated with a different risk allocation scheme.



Some of these project delivery methods are defined below:

**Design-Bid-Build (DBB):** In this traditional form of project delivery the design and construction of the facility are conducted by different entities. As a result, the DBB process is divided into two separate phases for design and construction.

**Design-Build (DB):** Unlike DBB, the DB approach combines design and construction phases into one fixed-fee contract.

**Design-Build-Operate-Maintain and Build-Operate-Transfer (DBOM and BOT):** Under a DBOM or BOT, the contractor is responsible for the facility's design, construction, operation, and maintenance for a defined/agreed period of time. This category includes "Availability Payments" discussed below.

**Design-Build-Finance-Operate-Maintain (DBFOM):** The DBFOM is a variation of the DBOM approach. The major difference is that, in addition to the design, construction, operation and maintenance of the project, financial risks are transferred to the private partner. While the project sponsor retains ownership of the facility, the DBFOM approach attracts private financing for the project that can be repaid with revenues generated during the facility's operation. Utilizing long-term public sources of revenue to pay down privately financed projects allows the public sector to enjoy the benefits associated with a leveraged project without issuing bonds or otherwise incurring debt on its balance sheet.

**Build Own Operate (BOO):** Under a BOO, the design, construction, operation, and maintenance of a facility are the contractor's responsibility. The major difference between BOO and other P3s is that with a BOO approach, the private partner owns the facility and is assigned all operating revenue risk and any surplus revenues for the life of the facility.

**Availability Payments** (AP): This mechanism accomplishes performance-based compensation in an asset that does not necessarily generate sufficient revenue to encourage private investment and can be used in conjunction with other P3 mechanisms where ongoing O&M responsibility exists. An AP requires private firms to accept risk related to the ongoing performance in the project's design, construction, and O&M. Concessionaires would receive periodic payments based solely on the condition and/or performance of the facility. Besides international examples, the $1.76 billion Florida I-595 project and the recent $1.2 billion Port of Miami Tunnel are two notable projects procured as APs and have generated intense interest among project sponsors both because it works with projects with weak revenue streams and because more controversial toll- or fare-setting and return on equity issues do not need to be considered.

## Public-Private Partnership Funding

The Authority's Financing Plan for the San Francisco-to-Anaheim system targets $10.0 to $12.0 billion in private sector participation. This projection is based on estimated construction and operating costs, independent ridership and revenue projections, and other available funding sources. This Financing Plan assumes normalized long-run market conditions. There are several different methods through which such investment could be obtained.

The targeted $10.0-$12.0 billion level of private sector investment is based largely on the amount of project-based debt ($7.5-$8.5 billion) the Authority believes could be supported based on future revenues. These estimated revenues were based on independent ridership forecasts available in November of 2009 and capital market conditions at that time. Implicit in these assumptions is some form of a revenue guarantee that would guarantee to private sector participants that a minimum level of

revenues would be received in the event that system revenues are significantly lower than forecasted. Without some form of revenue guarantee from the public sector, it is unlikely that private investment will occur at this level until demand for California's high-speed rail is proven. While capital markets have tightened since the initial projections, changes in certain variables, including increased gas prices, have resulted in higher projected ridership. P3 concessions would also benefit from depreciation tax treatment, which could also have a substantial impact on the level of private investment.

| Likely Risk Profiles for Investment in High Speed Rail | | | | |
|---|---|---|---|---|
| **Participant** | **Environmental** | **Construction** | **Ridership** | **Operational** |
| **Construction Firm** | No | Yes | No | No |
| **Vendor** | No | No | Some | No |
| **Operator** | No | No | Some | Some |
| **Equity Investor** | No | Limited | Some | Some |

In addition to considering private investment in exchange for future project revenues, there are other mechanisms for private participation that would support the project. Vendor financing is a key mechanism to consider given the equipment needs of the project. Such a mechanism would reduce the amount of up-front borrowing required and could reduce the cost of financing. Depending on the tax regulations applicable to the equipment owner, additional pricing benefits could accrue to the Authority through the vendor's capture of depreciation benefits. This technique would reduce construction costs through a small subsidy that export credit agencies could provide as part of vendor financing. Overall, this technique would allow for more substantive private participation earlier in the development of the system and it would allow the Authority to achieve a higher level of risk transfer.

Design-build contracting and other project delivery mechanisms also are vehicles that would allow the Authority to transfer significant design, construction and technical risk to the private sector entities best in the position to manage these risks. Although this may not generate up-front investment, these mechanisms can significantly reduce or eliminate the risk associated with increases in costs during construction or equipment development. Including operations and/or maintenance in a design-build contract (i.e., design-build-operate-maintain arrangements) also would allow for the transfer of operational risks associated with the project. If payment is based on performance or tied to operating revenues, such contracts provide considerable incentive for the private sector to run the facility as efficiently as possible. Private sector firms tend to be most willing to accept risk in those areas where they hold the most experience, leading such arrangements to require a multiparty private sector consortium, in most cases.

## RFEI Process and Results

In March 2008, the Authority issued a Request for Expressions of Interest (RFEI). The intent of the RFEI was to gain a better understanding of how the Project could benefit from private sector participation and to gauge the level of private interest in the Project. The Authority received written responses from 30 private firms, including construction firms, system and equipment providers, financial institutions, and operators. These respondents included major firms in each of these categories, providing a good sample from which to draw initial conclusions about private sector experience and preferences for involvement[32]. Their responses supported the Financial Plan's assumption of private sector interest in a P3 arrangement for the high-speed train project. In addition, the Finance team has conducted ongoing interviews with private sector participants to address changing market conditions especially after the passage of the American Recovery and Reinvestment Act and the CA State GO bond act.



32 For a more in-depth discussion of RFEI results, please see the 2008 RFEI Report. http://www.cahighspeedrail.ca.gov/images/chsr/20081118152745_Source%20document%209%20rfei.pdf

Respondents to the RFEI and subsequent telephone surveys were interested in participating through a variety of mechanisms, many of which would require integration of project components outside of their individual area(s) of expertise. Many respondents expressed concern about integration among the various project components and indicated that a design-build-finance-operate-maintain (DBFOM) or a design-build-operate-maintain (DBOM) approach could resolve these issues. Given the size of the Project, multiple project delivery mechanisms likely will be necessary, particularly for civil works contracts.

Respondents also discussed factors that would influence the level of private investment and participation. This discussion indicated that private parties are interested in investing in the project; however, the overall level of private investment and participation is highly dependent on the amount of risk to be transferred to the private sector entity. The most important factor was the level of commitment from public funding sources. Without strong state and federal support, many participants indicated they would not participate. Another critical factor was the need for a public policy mandate for the Project and clear P3 legal authorization. Many policy, legislative and state funding challenges have been addressed with the passage of the Bond Act in November 2008. In addition to the mitigation of these risks, respondents indicated that all environmental risk and right-of-way acquisition must be handled by the public sector.

Once the above factors have been addressed, the specific risks associated with individual contracts will become critical. There are a variety of issues with contracts, including, among others, performance guarantees and the timing and source of repayment. Specific concerns centered on the extent to which private investment is to be repaid through ridership revenues. Respondents perceive a high level of risk in such repayment due to the unique nature of the project and the lack of comparable modes of transport in the United States. While respondents indicated that some ridership risk is acceptable, due to a private party's expected role in increasing revenues, there is limited appetite for investment that would be repaid largely through ridership revenues without any type of revenue guarantee or availability payments from the project sponsor at this time. Investors' willingness to take on greater amount of ridership risk will increase as initial segments are completed and ridership meets or exceeds those projections.

Since the RFEI in 2008, the Authority has continued to reach out to the private sector to gauge interest in the Project as well as seek guidance on technical and procurement issues. In total, over 40 firms have expressed their interest in participating in the Project in their given area of expertise or as part of a bidding consortium. The Authority has also obtained memoranda of understanding from Chinese, French, German, Spanish, Japanese and Italian train manufacturers to encourage international cooperation. As the Project moves into 2010, the Authority is once again planning to consult the private sector as it moves forward with the beginnings of a procurement process. The Authority plans to give interested private firms the ability to comment on its planned Request for Qualifications (RFQ) process, before moving ahead with the formal RFQ. The Authority has begun to take this feedback and interest into account as it develops the Project in order to maximize private participation in the funding and construction of the system.

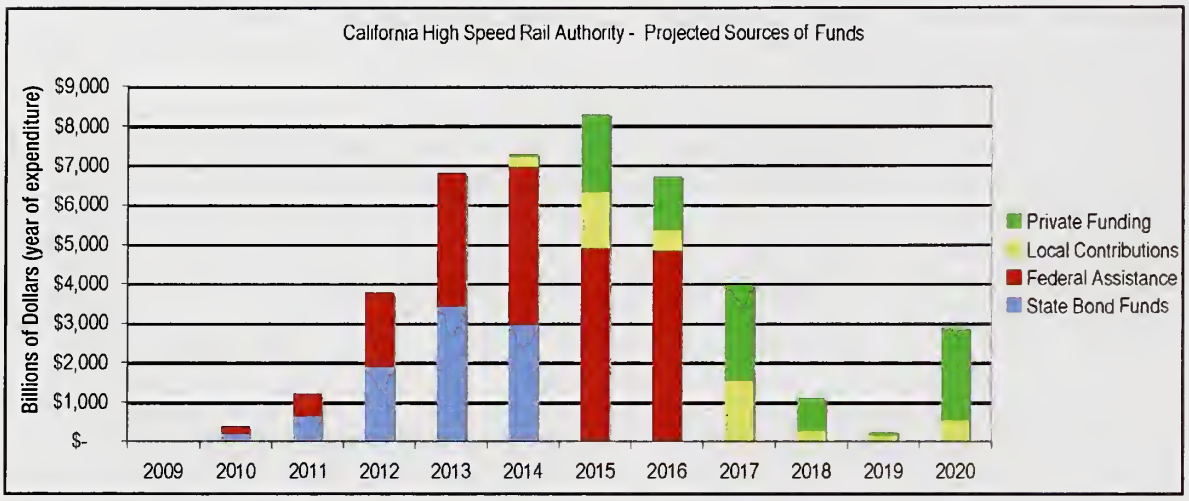
The Authority recognizes that there are a number of issues that remain to be resolved before the exact role and extent of private sector participation can be determined. However, such challenges are to be expected with a Project of this size, complexity, risk profile, and duration of development. For example, there will be risk and reward trade-offs, and various phasing and funding timing requirements, to consider before contracts for any given portion of the Project are undertaken. It is important to note, though, that the unknowns concerning private sector participation present an opportunity for the project, as the Authority can encourage competition within the private sector and

design P3 scenarios that are favorable to the project. As further information about specific Project sections is developed, the Authority will focus on designing P3 contract opportunities that achieve its goals and are attractive investments for the private sector.

## Timing and Phasing of Funds

### Introduction

The Financial Plan Team, in conjunction with the Authority's engineering consultants, has developed estimates for sources and uses of funds for the San Francisco-to-Anaheim Project




totaling approximately $42.6 billion (in year of expenditure dollars). The Authority expects to fund the $42.6 billion in total cost through targets of $17-$19 billion in federal grants, $9 billion in state funds, $10.0- $12.0 billion from public-private partnerships, and $4.0- $ 5.0 billion in local funding assistance and cost sharing.

## Timing and Staging of Investment for the Anaheim to San Francisco High-Speed Train System

The Authority's Financial Plan expects initial environmental studies and right-of-way acquisition for the project to be funded with public dollars from federal, state, and local sources. Initial contracts, including those funded through the ARRA stimulus package, would also be paid for largely with public dollars, although the Authority will leverage opportunities for private participation early in the Project through design-build contracts and other mechanisms. Although it may be feasible to achieve a partial ridership risk transfer early in the Project, it is probable that a firm or consortia accepting substantial compensation based on future operating surpluses will invest in the middle to later term of Project's construction period. This investment is based on ridership and will likely require some form of minimum revenue guarantee for private participants until demand for high-speed rail is proven in the United States and California. After several years of proven ridership, private participants are likely to accept a greater percentage of compensation subject to ridership risk.

Several respondents to the Authority's Request for Expressions of Interest indicated that although they were willing to accept some payment based on future operating revenues, they would be more likely to do so later in the Project's development. As a result, it will be important to secure the federal government as a partner early in the development process to provide funds to be coupled with state and local monies and fund early construction.

## California High Speed Rail Authority Business Plan: Discussion of Financial Model Used to Estimate Project Funding Sources

### Overview

The current California High-Speed Rail Project financial model includes scenarios for a 50-year, 75-year and 99-year concession beginning in 2010 and demonstrates the feasibility of the Project as a long-term public-private partnership. The model is developed as a public-private partnership or a concession and it assumes that the concession could take the form of a design-build-finance-operate-and-maintain (DBFON). The first part of the model focuses on the construction costs. As discussed above, the P3 portion of Project funded is estimated to be between $10-12 billion. The $10-12 billion will be made up of senior debt financing, a subordinate TIFIA loan, and a private equity contribution. The private funding capacity is sized based on the projected cash flows and assumptions regarding cost and structure of financing, associated with the timing of future cash flows and the risks associated with the project. It is assumed that remaining project funding will come from federal, state, and local grants.

### Capital Expenditures

Total upfront capital expenditures include costs for construction, systems and electrification, program implementation costs, and vehicle costs as shown below:

**Upfront Capital Costs (YOE $s)**

| | |
|---|---|
| Construction | $31.300 |
| Vehicle costs | 3.300 |
| Systems and electrification | 4.600 |
| Program implementation costs | 3.400 |
| Total | $42.600 |

As outlined in the previous sections, the construction costs are provided by section for the following seven sections:

- San Francisco to San Jose
- San Jose to Merced
- Merced to Fresno
- Fresno to Bakersfield
- Bakersfield to Palmdale
- Palmdale to Los Angeles
- Los Angeles to Anaheim

The construction costs are incurred over the years 2011 to 2018; vehicle costs are incurred over the years 2011 to 2035; systems and electrification costs are incurred from 2013 through 2019; and finally, program implementation costs are incurred over the years 2010 through 2020.

In addition to upfront capital expenditures, provisions are made for ongoing renewal and replacement costs.

### Operations

Operating revenues are earned beginning in year 2020, and operations and maintenance expenses are incurred beginning in year 2017 as preliminary testing and minimal operations may begin in 2017. The assumptions used for net operating cash flows are described in detail

in the ridership and revenue section of this Business Plan and are summarized below:

**Operating Cash Flows (YOE $ Ms)**

| | 2020 | 2025 | 2030 | 2035 | 2040 |
|---|---|---|---|---|---|
| Operating revenues | 1,310 | 4,100 | 5,120 | 6,190 | 7,459 |
| Operations and maintenance expenses | 940 | 1,630 | 1,940 | 2,310 | 2,678 |
| Net operating surplus | 370 | 2,470 | 3,280 | 3,180 | 4,781 |

Based on the operating plan and the ridership and revenue figures presented in previous sections, the operating revenues are summarized in the chart above. Operations and maintenance expense assumptions are also laid out in the previous chapter and summarized in the chart above. In the first year the net operating surplus is approximately $370 million and increases to almost $3.9 billion in 2035. These represent significant operating surpluses. The above assumptions are based on fares being set to 83 percent of average airfares for comparable routes[33].

## Funding and Financing

The breakdown of total funding sources of up-front capital costs is shown below:

**Funding Sources Summary (YOE $ M)**

| | |
|---|---|
| Federal grants | $17,009 - $19,000 |
| State grants | $9,000 |
| Local grants | $4,000 - $5,000 |
| Private funding | $10,000 - $12,000 |
| Total | $42,600 |

## Private Sources

The model assumes that the private sources of funding include senior debt in the form of Private Activity Bonds (PABs), a subordinate TIFIA loan, and private equity. In order to maximize borrowing amounts, minimum required debt service coverage ratios are assumed to be 1.40 for senior debt service, and 1.10 for aggregate debt service. However, it is also assumed that lenders will require a minimum equity contribution of 20 to 25 percent of the private funding amount. Therefore, since this requirement is the constraining factor for debt issuance, the actual minimum debt service coverage ratios are in fact higher than the required minimum ratios (2.22 for senior debt service, and 1.44 for aggregate debt service). It is assumed that the TIFIA issuance amount cannot exceed the senior debt amount; therefore, these two issuance amounts are equal. Additionally, the TIFIA loan amount is considerably less than 33 percent of total project costs. Finally, in order to calculate the total private funding capacity, an after-tax equity internal rate of return (IRR) or investment hurdle rate of 16 percent has been assumed. Based on this model, a sample breakdown of privately funded sources of up-front capital costs is shown below:

| Sample Breakdown of Private Sources (YOE $ Ms): | | |
|---|---|---|
| Senior debt | 35.3% | $4,260 |
| TIFIA debt | 35.3% | 4,260 |
| Private equity | 29.4% | 3,539 |
| Total | 100.0% | $12,059 |

## State, Local, and Federal Grants

It is assumed that the balance of the funding requirement will be met by government grants. Since the state has already authorized up to $9 billion, it is assumed that the state's contribution will remain constant at this amount. It is also assumed that local sources will fund $4-$5 billion of the up-front capital costs. Finally, it is assumed that the remaining need of $17-$19 billion will be met by grants from the federal government.



33 Refer to Table B within the Ridership, Revenue & Operations Chapter

# Economy / Climate Right Now

**ARRA and Other Federal Funding**

President Obama has launched a national high-speed train initiative with $8 billion in new stimulus funding under the American Resource and Recovery Act and another $1 billion a year for high-speed trains over the next five years in the federal budget. California is the best-prepared state to receive and maximize the benefit of ARRA funds for high-speed train development and is expected to be a leading candidate for a significant share of stimulus funding. It's the only high-speed train project that can meet three major tests in qualifying for those funds:

- Billions of dollars in voter-approved state funding committed to the project
- Significant environmental clearances completed or underway
- Construction projects that can break ground by 2012

Congress also has indicated its interest in financing development of high-speed train systems in America and key congressional leaders have said they want to expand on the president's call for investment of an additional $1 billion a year over the next five years.

## Demand for New Transportation Alternatives

California's culture and economy are built on mobility. When voters approved Proposition 1A in 2008, they demonstrated their support for a new 21st century option that would ensure they maintain that mobility.

Over the next two decades, California's high-speed train will alleviate the need to spend more than $100 billion to build:

- 3,000 miles of new freeway
- Five airport runways
- 90 departure gates

## Economic and Social Impact of a High-Speed Train

In tough financial times, a project of this magnitude will have a significant impact, even in the short term. Construction start-up of ARRA-funding-related sections by 2012 is expected to generate 130,000 early jobs and kick-start economic

In the face of unprecedented worldwide interest in high-speed trains, President Obama's financial and political commitment to create a system in the United States, and California voters' approval of a $9 billion state bond fund for such a project, have positioned California to be at the leading edge of public and private investment in high-speed rail.

California's system will help meet the state's historic demand for mobility. But what's more, it will create jobs, stimulate the economy, and provide new opportunity for private investment at a time when our state needs it most.

Despite a worldwide economic downturn over the past two years, American and international companies and consortiums have strongly voiced interest in investment in California's system. Early in 2010, the Authority plans to step up efforts to identify potential public-private partners (P3).

activity in design, construction and supply services. Over the longer term, California's high-speed train will mean:

- Nearly 600,000 construction-related jobs
- 450,000 permanent jobs
- Improved movement of people, goods and services
- Faster travel times for many
- Congestion relief for freeways and airports
- Improved air quality and related-health care costs
- More energy efficiency – only 1/3rd the energy of airplanes, 1/5th the energy of passenger cars
- Reduced dependence on foreign oil by 12.7 million barrels a year
- 12 billion fewer pounds a year in greenhouse gases
- Revitalization of many of the communities around new transportation terminals

## Job Creation

California's unemployment rate stands today at a historically high level, especially in certain regions of our state such as the Central Valley. Infrastructure projects have been proven as job creators that have the ability to help to pull economies out of recessionary times.

California labor leaders support the high-speed train project and have begun to do so vocally because they understand the job creation that would come along with such an infrastructure project. President Obama has focused on the available ARRA funding for high-speed intercity rail as a significant job creator.

In California, the initial system is projected to create the equivalent of 600,000 full-time, one-year jobs over the course of its construction. While the calculation is a bit more complex, a simplified and conservative version puts the creation of both direct and indirectly related jobs for an infrastructure project of this sort at 20,000 total generated per $1 billion of construction. So, roughly, that means the California high-speed train project's job creation, broken down by region of the project, would be:

- San Francisco – San Jose: 105,000
- San Jose – Merced: 112,000
- Merced – Bakersfield: 135,000
- Bakersfield – Palmdale: 81,000
- Palmdale – Los Angeles: 125,000
- Los Angeles – Anaheim: 92,000

## Current Interest In High-Speed Rail in General and California's Plan in Particular

Interest in investing in high-speed trains appears to be at unprecedented levels both in America and around the world. Numerous countries, including Russia, Poland and Brazil are investing in establishing high-speed train lines, while others are adding to their existing systems. Private companies and foreign governments are gearing up to invest in doing so here. This is due in part to President Obama's commitment to high-speed rail development in the United States. In California, it is also due in large part to the voters' approval of $9 billion in state bond funds for the project. Other factors raising interest in high-speed rail investment are the job creation of such an infrastructure project and the view that infrastructure investment and public-private partnerships are more sound investments in the current economy than the financial markets.

While the Authority's previous work formally gauging private-sector interest was conducted largely before the passage of Proposition 1A and the president's stimulus plan announcement, continued interest from and contact with private entities and foreign consortiums tell us that this interest has increased. The Authority plans to, in the early months of 2010, prepare a process by which interested private entities can express their interest in participating in the California high-speed rail project, lay out their qualifications for doing so and their envisioned role.

## Private Sector Interest

Over the past two years, the Authority has undertaken extensive work to gauge and encourage private sector interest in the High-Speed Rail project. In March 2008, the Authority issued a Request for Expressions of Interest ("RFEI"). The purpose of the RFEI was to gain a better understanding of how the Project could benefit from private sector participation and to gauge the level of private interest in the Project. Responses were received from 30 private firms, including construction firms, system and equipment providers, financial institutions, and train system operators. Respondents included major firms in each of these categories, providing a good sample from which to draw initial conclusions about private sector experience and preferences for involvement[34].

Some interested respondents to the RFEI expressed concern that participation would require integration of project components outside of their individual area(s) of expertise. But many indicated that a design-build-finance-operate-maintain ("DBFOM") or a design-build-operate-maintain ("DBOM") approach could resolve these issues. Given the size of the Project, multiple project delivery mechanisms likely will be necessary, particularly for civil works contracts.

While the majority indicated that they would make a financial investment in a project like California's high-speed train, respondents pointed out that the type and amount of their participation would depend on the level of risk associated with such an investment. Clear public funding commitments, well-defined projects, and proper allocation of project risks ranging from construction and environmental to technical and future ridership were cited as vital to a private firm's decision to invest in the project. The Authority has begun to take steps to encourage private investment, but these topics will be further developed as the project moves forward.

Since the RFEI in 2008, the Authority has continued to reach out to the private sector to gauge interest in the project as well as seek guidance on technical and procurement issues. In total, over 40 firms have expressed their interest in participating in the project in their given area of expertise or as part of a bidding consortium. The Authority has also obtained memoranda of understanding from French, German, Japanese, and Italian train manufacturers to encourage international cooperation. The Authority is once again planning to consult the private sector as it moves forward with the beginnings of a procurement process in 2010. The Authority plans to give interested private firms the ability to comment on its planned RFQ process before moving ahead with any formal RFQs. The Authority has begun to take this feedback and interest into account as it develops the project in order to maximize private participation in the funding and construction of the system.

The Authority recognizes that there are a number of issues, including the level of risk facing investors, that remain to be addressed before the exact role and extent of private sector participation can be determined. Nevertheless, private investment interest is expected to be strong and key to long-term success of California's system. A variety of challenges are to be expected with a project of this size, complexity, risk profile, and duration of development. For example, there will be risk and reward trade-offs, and various phasing and funding timing requirements to consider before contracts for any given portion of the project are undertaken. As further information about specific project segments is developed, the Authority will focus on designing P3 contract opportunities that achieve its goals and are attractive investments for the private sector.

34 For a more in-depth discussion of RFEI results, please see the 2008 RFEI Report

# Subsequent Sections

## Los Angeles to San Diego via the Inland Empire

In addition to the Initial system described in depth in this document, the High-Speed Rail Authority is planning and conducting environmental reviews on additional sections that would result in a total system about 800 miles in length linking Sacramento, the San Francisco Bay Area, the Central Valley, Los Angeles, Orange County, the Inland Empire, and San Diego. Additionally, the Authority is working on a separate "Altamont Corridor Rail Project" which complements the high-speed train system. The Altamont Corridor Rail Project is being done in partnership with the San Joaquin Regional Rail Commission (SJRRC) and other local and regional agencies to improve passenger train service over the Altamont Pass.

Proposition 1A provides that the Los Angeles to San Diego via the Inland Empire and the Merced to Sacramento sections, as well as the Altamont Corridor Rail Project, can also compete for and use the bond for capital costs with available funding as long as there is no adverse impact on the Phase 1 priority section.

This section gives an update on the progress of the Los Angeles to San Diego via the Inland Empire, Merced to Sacramento sections, and the Altamont Corridor Rail Project. Each are currently in the very early stages of project-level environmental review, however significant progress has been made to move each of these corridors forward toward implementation.

Since 2008, the Authority has collaborated with the Southern California High-Speed Rail Inland Corridor Group (SoCal ICG), which was formed by a Memorandum of Understanding (MOU) signed by the Authority and Southern California Association of Governments, Los Angeles Metro, San Diego Association of Governments, San Bernardino Associated Governments, the Riverside County Transportation Commission, and the San Diego County Regional Airport Authority. One of the purposes of the SoCal ICG is to demonstrate partnership with regional entities and to assist the Authority with the review of the Program EIR/EIS alternative alignments and station locations and in identifying additional alternative project alignments and optional station locations to be studied in the Los Angeles to San Diego via the Inland Empire Project EIR/EIS. The Authority has consulted with the SoCal ICG on a monthly basis since the summer of 2008.

To support the development of the Los Angeles to San Diego via the Inland Empire section of the high-speed train system, the SoCal ICG partner agencies formed four Technical Working Groups (TWGs) in Los Angeles, Riverside, San Bernardino, and San Diego Counties. The TWGs met with the Authority in November, 2008, February, 2009; and July/August, 2009 to identify additional alternative alignments and optional station locations to be further considered in the Project EIR/EIS along with the alignment alternatives and station locations selected with the 2005 Program EIR/EIS. In addition, alternative sites for right-of-way maintenance, train storage facilities and a train service and inspection facility will be evaluated in the LA-SD Section via the Inland Empire of the project area.

The Los Angeles to San Diego via the Inland Empire Section would extend from Los Angeles through the San Gabriel Valley, to Ontario Airport and the Inland Empire, and terminating in San Diego. The alignment corridor alternatives include the following as listed in the three sub-sections below:

**Los Angeles to Ontario Sub-Section**

- UPRR
- UPRR Adjacent
- State Route 60
- Interstate 10
- Holt Boulevard
- Metro/Metrolink

Ontario to Murrieta Sub-Section

- UPRR
- BNSF
- SANBAG/Metrolink
- Milliken Avenue/Interstate 15
- Interstate 215

Murrieta to San Diego Sub-Section

- Interstate 15
- Carroll Canyon Road
- Miramar Road
- LOSSAN / Interstate 5

**The candidate station stops** in the Los Angeles to San Diego via the Inland Empire Section have been identified include the following:

- San Gabriel Valley (El Monte, West Covina, City of Industry, Cal Poly Pomona, Pomona)
- Ontario Airport
- San Bernardino
- Riverside
- March Air Reserve Base
- Corona
- Murrieta
- Escondido
- University City
- San Diego (Downtown, Lindbergh Field)

### Current Process

The Los Angeles to San Diego via the Inland Empire section completed the public scoping comment period in November 2009. The team is currently evaluating scoping comments that include additional alternative alignments in Los Angeles and San Diego counties. These alignment alternatives include Interstate 10 west of Interstate 605 to Los Angeles Union Station and an alternative Interstate 15 alignment from Mira Mesa to Lindbergh Field. Alternatives will be refined as the project continues.

Currently, the team is developing a draft scoping report and initiating the alternatives analysis (AA) process, to be completed by the end of 2010. During the AA process, SoCal ICG and TWGs will continue in each of the four counties to review and provide input into the development of the alignment and station alternatives. This process also includes coordination with Caltrans (District 11, 8, and 7), Resource Agencies, 100+ cities within the Section, and local agencies and stakeholders. Each partner represented by the SoCal ICG also participates in a Public Relations and Policy coordination effort and meets on a regular basis.

### Timeline

It is anticipated that the environmental review could be completed for the Los Angeles to San Diego via the Inland Empire section by end of 2013, with construction dates to be established based upon available funding.

## Merced to Sacramento

### Description

The Merced to Sacramento section would extend north from Merced – where the train system backbone (Phase 1) turns west to reach the Bay Area – and connect to the capital city generally following a UPRR or BNSF / short line railroad alignment terminating at the existing Amtrak and light rail intermodal terminal at the historic Southern Pacific railyard site in downtown Sacramento.

Four candidate stops have been identified: Merced, Modesto, Stockton and Sacramento. The environmental process which is underway for the Fresno – Merced section has narrowed down the station location in Merced to a preferred site along the UPRR. There are two alternative station options for Modesto, a downtown site along the UPRR and a suburban site currently served by Amtrak along the BNSF. A downtown location near the existing ACE station along the former Southern Pacific (now UPRR) is preferred and the local preference in Sacramento is for the existing historic depot in downtown in that city as well.

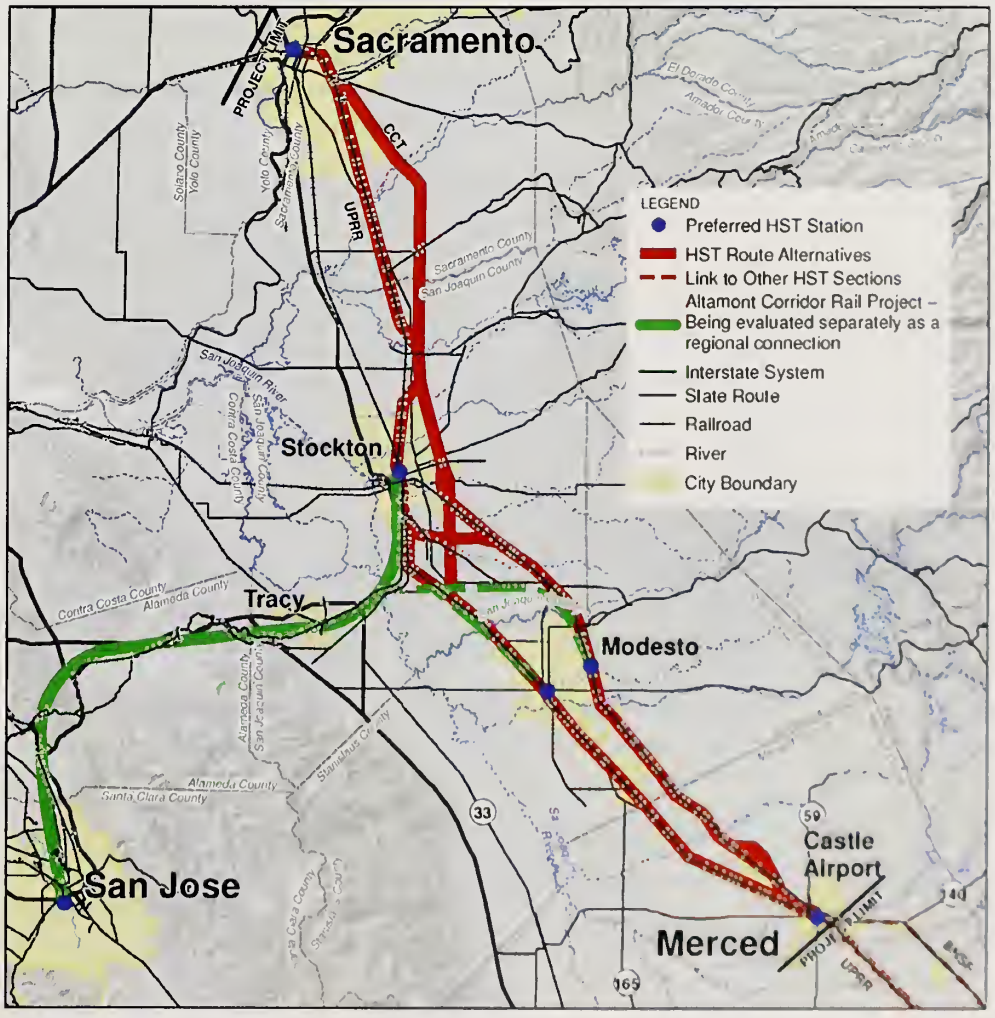
In addition to supporting operation of statewide HST trains, this segment could support regional intercity services which would include additional stops of significance within the region. Also, these regional services could be provided both north-south along the Central Valley main spine of the HST system as well as connecting services via the Altamont Pass route which, is being developed as a complementary regional route in conjunction with the statewide HST system.

The Authority has signed Memoranda of Understanding (MOU) with both the City of Sacramento as well as the SJRRC, which is owner and manager of the ACE intercity and commuter rail service.

The City of Sacramento has expressed strong sentiment to support developing the entire length of the corridor and bringing the line all the way to downtown where it would meet the Regional Transit LRT system (including an airport connection presently under development), Amtrak long-haul passenger trains, and the Capitol Corridor intercity rail service which would serve as a feeder to the HST system.

SJRRC has a vision to operate regional intercity services along the segment that would serve the four HST stops as well as additional regional stops located between the HST stops, which could be supported with additional investment, such as providing four track stations with station tracks to avoid delays to the HST services along the main line. Accordingly, SJRRC has signed a MOU with the Authority to jointly plan the infrastructure and is assembling sources of local funds to augment the planning, design and construction effort being undertaken by the Authority.

Work to date has been accomplished in this corridor to answer resource agency questions regarding water quality impacts along the UPRR north of Stockton as well as preliminary layouts for the Sacramento terminal to provide input into the City of Sacramento ongoing process of refining the master plan for the intermodal station area.



### Current Process

The Federal Railroad Administration has agreed to allow the formal environmental process commence in early 2010 with issuance of a Notice of Intent / Notice of Preparation (NOI/NOP) and scoping meetings to engage the public, staffs and policy makers in the corridor. In anticipation of the issuance of the NOI/NOP the Authority has initiated a comprehensive effort, including agency coordination as well as public outreach, to engage the participants in the environmental clearance process.

It is anticipated that funding for the balance of FY09/10 will allow the project to follow up on the scoping meetings with development of an alternatives analysis, which will identify the most promising alignments and station locations to be evaluated in the EIR/EIS.

### Timeline

It is anticipated that environmental review could be completed for the Merced to Sacramento section by 2014 with construction dates to be established based upon funding availability. Although this is a "Phase 2" section, the funding outlook includes the potential for future federal funding for both intercity as well as commuter rail, and local transportation funding such as may be assembled by SJRRC working in conjunction with the Authority and potential state level funding.

## Altamont Corridor Rail Project

### Description

The Altamont Corridor Rail Project will develop a new regional rail passenger corridor supporting intercity and commuter services that will upgrade the existing ACE service owned and managed by the SJRRC in the near term as well as be compatible with the statewide HST system in the long term. While this project is not part of the high-speed train system, this corridor is formally recognized as eligible for funding through Proposition 1A funds and California included the Altamont Corridor Rail Project in its request for funding under the high-speed rail provisions of the American Revitalization and Reinvestment Act (ARRA) "stimulus" initiative.

As a joint-use corridor, the Altamont Corridor Rail Project can be improved incrementally by providing new, higher-speed passenger tracks for existing ACE equipment or "second generation" ACE consists capable of higher maximum speeds. The corridor has the potential to attract significant intercity and commuter ridership as it occupies a key topographic "gateway" between the Bay Area and northern San Joaquin Valley through which existing travel is focused. In addition, the corridor can serve as a feeder to the statewide HST system by connecting to the Merced – San Jose – San Francisco section of the main line in San Jose as well as to the Merced – Stockton – Sacramento phase two main line in Stockton and Modesto.

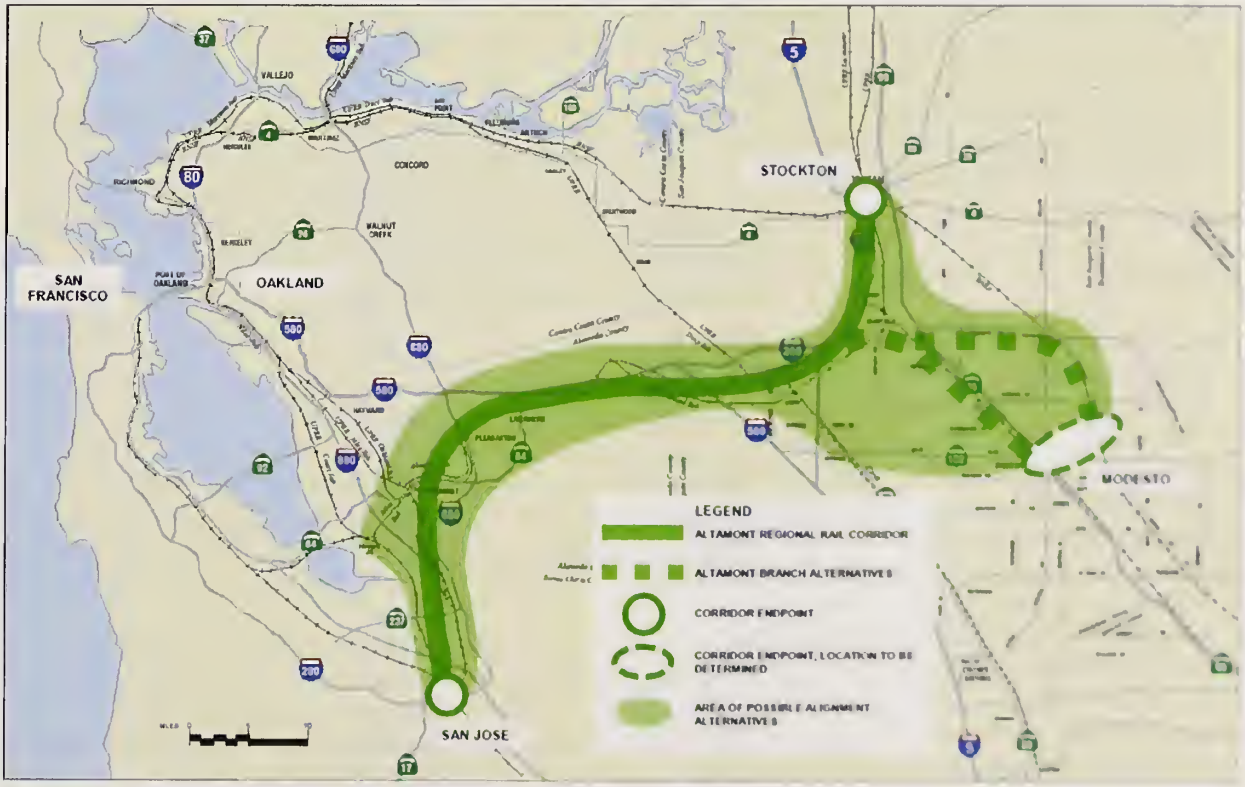
The Authority has developed the Altamont Corridor Partnership which includes more than a dozen regional transportation, planning and government entity partners which through the venue of the Altamont Corridor Partnership Working Group have developed consensus on the overall route, key objectives, planning principles, and major project elements including the general route location, candidate stations, key project features, as well as phasing and staging considerations.

The Authority has signed Memoranda of Understanding (MOU) with three entities that engage this corridor, including Caltrain, SJRRC and the City of Sacramento, and approved the signature of an MOU with BART.

Under the venue of the various MOU's, the Authority and its partners are seeking to develop a linkage to the BART system to extend the coverage beyond the immediate corridor route principally in the East Bay, linkages with the Caltrain system to serve the Peninsula; and most importantly, the agreement with SJRRC recognizes the interest of that entity to operate regional intercity and commuter services along the Altamont Corridor, which could extend beyond onto the high-speed train mainline tracks in the Central Valley such that operation of a Sacramento to San Jose train via the Altamont route may be possible.

The Authority developed a specific description of the initial project description, as well as the goals, purpose and benefits, which was considered by the FRA and which led to the FRA agreeing to serve as the lead federal agency (with the Federal Transit Administration as a cooperating agency) for the NEPA process. In addition, SJRRC has agreed to be a responsible agency under CEQA in conjunction with the environmental process.

The extensive agency coordination that was accomplished to develop the consensus within the Working Group to advance the project was supplemented with a large outreach effort that culminated with four scoping meetings held along the 80+ mile corridor to kick off the formal environmental process.



## Current Process

The Authority is reviewing the input received at the scoping meetings and will consider this information along with prior information developed during preparation of the Bay Area to Central Valley Program EIR/EIS to delineate and make a preliminary assessment of candidate alignments and station locations. This will result in the completion of a Draft Alternatives Analysis by June of 2010.

Special focus is being given on informing the parallel progress being made by BART on the BART to Livermore EIS. BART recently circulated a Draft EIS/EIR that includes nine alternatives for extending to Livermore with various opportunities for providing a joint intermodal station with ACE and the future Altamont HST line. The Authority had previously identified numerous candidate segments within the Tri Valley area for HST through the 2005 Statewide EIS/EIR and 2008 Bay Area to Central Valley EIS/EIR. The focused work will provide input to the BART process leading to the narrowing of BART alternatives ultimately designating a preferred option concurrent with the Authority substantially completing its alternatives analysis for the same area.

## Timeline

It is anticipated that environmental review could be completed for the Altamont Corridor by 2014 with construction dates to be established based upon funding availability. Although Altamont Pass is not part of the "Phase 1" main line between Los Angeles and San Francisco, it is eligible for state bond funding, and local partner SJRRC is assembling sources of funds to support not only the planning and environmental process but also right-of-way acquisition and construction of near-term beneficial phases in conjunction with anticipated future federal funding. The actual construction dates will depend upon the magnitude of the specific improvements and available funds.

# Risks and Mitigation

## Risks That Could Jeopardize Project Completion

For the purpose of this report to the Legislature, and at this current juncture in the development of California's high-speed train project, it is important to ask the question, "What factors exist that could derail the project and delay or prevent its ultimate completion?" Any infrastructure project faces its share of risk, and this project is no different. The California High-Speed Rail Authority believes it is aware of the existing risks and is taking, or has plans to take if necessary, the appropriate steps to prevent and mitigate those threats. Below is a discussion of those existing risks and how the Authority would guard against them impacting the delivery of a high-speed train system.

A project of this size, scope and nature faces a number of risks that could jeopardize its completion. Any frank discussion of the project and its planning must include these risks, and any credible plan for the project must address how these risks would be mitigated. This section describes those risks in a frank manner and notes the manner in which the Authority plans to mitigate them. General categories of risk include funding, politics, litigation, federal regulations, construction, and unpredictable events.

## Funding

The Project will likely be exposed to three major types of financial risks, typical of projects of this size and of any financing that seeks capital in the U.S. and international markets. The most basic risk is that the project does not win the credit approval from the financial institutions, including banks, credit rating agencies, funds and underwriters, that will provide the capital directly or as an intermediary to the project. In addition, the project may not receive approval from the investment oversight committees of the respective strategic investors (such as construction firms, vendors).

The second set of risks are overall market risks. As we have experienced in 2008 and 2009, the financial markets may essentially "shut down" for all but the highest creditworthy financings. This may apply to both bank financings as well as capital market transactions. Furthermore, the capital of strategic investors may also be constrained as they focus on maintaining liquidity.

The third set of risks is that governments are not able to follow through on their grant and loan commitments. For instance, Congress could delay funding transportation programs, such as the TIFIA program, which could imperil part of the financing, since this may become a key funding source. Or, as California is experiencing now, California's credit ratings could affect the project's ability to issue GO bonds.

To mitigate these risks, the Authority will consider a number of mitigation techniques. For the first risk – credit and approval risks – the Authority and its financial team will work closely with the financial markets and investors to clearly communicate the project and obtain up-to-date feedback. The Authority should have a very clear idea whether approval can be obtained and what kind of changes need to be made for the markets to accept the project.

For the second type of risk – overall market risks – the Authority has to be continually monitoring the market and develop strong "back-up strategies." For one, this means following a dual bank/capital markets strategy, so that if one market closes, the Authority can access the other one. In addition, the Authority may want to develop project segmentation strategies that allow for the development of certain segments even if other segments are delayed due to turbulence in the financial markets. In essence, this is what the Authority is already considering with the proposed ARRA segments that will be built to ensure independent utility in case the connecting segments are delayed. In a similar way, the Authority needs to plan for the third set of risks – lack of government follow-through – by carefully assessing how each government funding source affects the build-out of each segment.

## Politics

Political support is critical to a project of this size, scope, and corresponding funding needs. To be successful, the Authority must build strong partnerships with state, local, and federal legislators.

A valid risk to completion of this project is a lack of political support and will to see it through to completion.

However, when speaking of mitigating the risk of waning political support, it's important to note that political support currently is doing the exact opposite – it is increasing exponentially. The most notable example of that is President Obama's inclusion of funding within the American Recovery and Reinvestment Act for high-speed intercity rail, and his publicly laid-out vision for building a network of high-speed train lines in this country.

The President's support of high-speed rail has served as a catalyst to build political support for the project at all levels. Members of California's congressional delegation have publicly expressed support for the project, as have local governments and several California state legislators.

To mitigate the risk of losing political support, the Authority will work diligently to build partnerships with elected officials and to inform them regularly about the project's progress. This goes for our representatives in Washington, D.C.; our state Legislature; and locally elected officials.

Additionally, the Authority will strive to maintain a project that is on track and on budget, and that places a premium on accountability and transparency. Through this, political support will remain.

## Legal Action

Legal action being brought against the Authority is a likely risk. Negative rulings in such lawsuits have the ability to set the project's timeline back or even halt the project or sections of it for a time.

The possibility of lawsuits is likely centered on environmental work or public outreach related to construction and mitigation factors. So, to mitigate the likelihood of such lawsuits and the merit behind such lawsuits, the Authority is committed to thorough and more-than-adequate environmental work. By conducting solid environmental studies, the Authority substantially reduces the risks associated with possible legal action.

Additionally, the Authority is committed to copious amounts of public outreach, and in recent months, has taken steps to augment and improve its outreach efforts. By providing thorough, frequent, adequate, and easily accessible information about the project's details and progress, we are confident that we can mitigate any possible risk that would result from inadequate outreach.

Another legal difficulty could arise within the design and construction phase (licenses; patent rights; outsider suit; insider suit; force majeure;

contractual issues due to misinterpretation, misunderstanding, failure, inappropriate strategy or contract) and is discussed within the design and construction risks section below.

## Ridership Factors

Solid ridership projections are necessary to build support in the private sector for the high-speed rail project. If it were to be projected that potential ridership on the system would be low, private entities would be less willing to provide funding for the project, and since our financial plan requires private participation, that would represent a threat.

The Authority's ridership projections are based on a number of factors that could possibly change between today and the construction phase, and which would then increase or depress ridership projections. This is not a highly likely risk but is worth mentioning.

Ridership estimates are in part based on population projections and on the cost of competing modes of transportation at the time that the system is operational. California's population is expected to grow by a third, to 50 million people, by 2030. If California's population over the next couple of years was instead to begin to decrease, that would materially affect high-speed rail ridership estimates. Also, the price of gasoline could drop dramatically and affect the ridership estimates; or, medium-distance airlines could improve efficiency and drop prices while adding additional routes, which would affect ridership projections.

These possibilities would be mitigated by policies that continue to draw people to reside in California and that encourage high-speed rail as an alternative mode of transportation preferable to other modes.

## Federal Regulations

The Authority is coordinating closely with the Federal Railroad Administration and high-speed rail industry to develop U.S.-based High-Speed Rail Express regulations and standards. Implementation of HSR Express in the United States requires a thorough assessment of the technical and operational safety risks, and application of best practices from existing systems to mitigate these risks. This is particularly critical as the California high-speed train project will be the first HSR Express system to be constructed and operated in the U.S. It is also important that the technical standards reflect an overall set of guiding principles, or system requirements, to ensure that all aspects of a high-speed rail network are addressed and integrated.

As we work to develop these standards, there is the possibility that necessary standards will be rejected, or that they will not be established in the timeframe necessary to match our timeframe for passenger service. However, mitigation for that possibility is already well underway. The Federal Railroad Administration is the agency that sets the safety standards to be met and is the Authority's federal partner for environmental work on the California high-speed rail project. The FRA works with the Authority on a daily basis, is well-versed on the details of our project and its regulatory needs prior to service, and will serve as a vital partner in the process of pursuing and establishing these standards – standards that will serve subsequent high-speed rail lines in other states as well.

## Technical Peer and Industry Review

The California High-Speed Train Project, with operating speeds up to 220 mph, will be the first modern high-speed rail system in the United States to exceed speeds of 150 mph. This requires the development of technical standards for the design and construction to accommodate the higher speeds. The technology leading to 220 mph high-speed train service has been in development for decades around the world with most systems operating at 200 mph and two systems (Spain

China) operating or soon-to-be operating at 220 mph. Many of these systems can be referenced for the development of U.S.-based technical standards.

For the past decade, the California High-Speed Rail Authority has been in regular discussion with nearly all of the operating high-speed rail operators and many of the manufacturers of high-speed train equipment around the world. These discussions include technical working groups to solicit technical peer and industry review in two primary areas: technical feasibility and manufacturing practicality. High-speed train systems are made up of highly technical subsystems that are optimized to work together to maximize safety and reliability. To confirm that the California project's technical approach is consistent with state-of-the-art practice, dozens of reviews and discussions have taken place during the development of the California high-speed train project. These include operators, infrastructure owners, international high-speed rail technical services organizations and manufacturers from France, Japan, Germany, Spain, China, Taiwan, and Korea.

## Right-of-Way Preservation and Acquisition

The high-speed train project, of course, hinges on the ability to obtain the right-of-way in which to build it. Inability to obtain adequate right-of-way would delay or prevent the system from being built. Primarily, any delay would come in the form of lawsuits seeking to prevent the Authority from acquiring a property.

The Authority plans to mitigate this risk through negotiations and by offering fair prices for right-of-way property. The Authority aims to settle disputes through negotiation and through transactions that are satisfactory to all parties. However, while it is not a tool the Authority wishes to employ nor will employ lightly, it should be noted that eminent domain is a tool the Authority has.

The Authority, with its program management team and regional consultant support, will lead the right-of-way preservation and acquisition tasks. This work will include identification of "at-risk" parcels, preparation of survey documents and legal descriptions, and preparation for property acquisition negotiations.

## Design and Construction Risk

Design and construction risk is generally associated with delays in construction and increases in construction costs. To reduce and limit the Authority's exposure to these risks, the Authority will take the necessary steps to share and/or transfer this risk with their private partners through innovative procurement and contracting methods. These contracting methods should ensure on-time delivery at a high level of performance by contractors by linking a large amount of their compensation to meeting project completion and performance standards, to cost overruns and delays in completion subject to significant penalties.

Effective design and construction risk management is essential to achieving a successful overall project. Therefore, incorporating risk analysis as an integral part of project delivery is key to project success. Risk management begins with identification of risk, developing a thorough understanding of their impact, and finally implementing risk mitigation measures into the procurement and project development process. To manage systematically with the various risks encountered on projects, a detailed listing of key project design- and construction-related risks are presented below grouped according to the primary source of risk rather than their associated effects:

### EXTERNAL RISK

- Regulatory Risk (unanticipated government intervention in dealing with: environmental issues; design and/or production standards; site selection and location; or special requirements)
- Natural Hazards Risk ( such as: corridor location; storms and/or floods; and earthquake)

- Completion Failure (failure of the supporting infrastructure due to others, such as design failure, or, execution of supply contracts due to bankruptcy or receiverships, etc.)
- Other Potential Risks include but are not limited to (vandalism; sabotage; indirect effects such as environmental and/or social; failure to provide financial support through the end of the project; or the lack of final project acceptance by the Authority)

EXTERNAL PREDICTABLE RISK

- Market Risks (availability of materials; material escalation; demand on critical elements; or economic unrest)
- Operational Risk (such as not properly identifying or dealing with maintenance needs; safety issues; or fitness for purpose)
- Environmental; Social Inflation; and Taxation Risks

TECHNICAL RISK

- Changes in Technology (rendering parts obsolete; discontinuation of parts; new technology complexity on the existing system rendering it obsolete)
- Performance (compromised quality and reliability due to design inadequacies; or sheer size and complexity of the project)

NON-TECHNICAL RISK

- Managerial Risk (lack of organizational structure; lack of appropriate policies and procedures; inadequate project management; staff changes; and inadequate planning and unrealistic completion schedule)
- Schedule Risk (delays and time overruns due to: regulatory approvals; labor shortages; productivity; stoppages; material shortages or late deliveries; unforeseen site conditions; accident or sabotage; scope changes)
- Cost Risk (overruns due to: schedule delays; inappropriate procurement strategies; contractor claims; management and/or workforce inexperience)

## Cash Flow Risk

LEGAL (generally controllable)

- Difficulties arising from any of the following: licenses; patent rights; outsider suit; insider suit; force majeure; contractual issues due to misinterpretation, misunderstanding, failure, inappropriate strategy or contract

With different project delivery options at its disposal the Authority will develop and employ strategies to evaluate and select the appropriate procurement methodology and approach. While many of the traditional evaluation criteria for procurement of engineering services still apply. the ability to evaluate contractors on more than a "reasonable and responsive bid" will introduce myriad new challenges to the procurement process. To facilitate a smooth procurement process, and ultimately successful delivery, it is important to maintain two closely linked processes moving forward.

The ideal project delivery method and procurement strategy should result in a high-quality facility at the earliest possible time for the lowest overall lifecycle cost (construction and operations and maintenance). So how will the Authority find this optimal strategy? As the owner of the facility, the Authority is in the best position to evaluate the specific issues surrounding the project. Things such as stakeholders, schedule, budget constraints the ability to manage, and the level of the Authority's involvement are all taken into consideration in selecting a delivery method and procurement strategy. The project delivery methods and procurement strategies evaluated for our efforts included:

- Design-Bid-Build
- Construction Management at Risk
- Design-Build
- Progressive Design-Build
- Multiple Prime Contracts
- Performance-Based Delivery

**The DESIGN-BID-BUILD** procurement and contracting strategy is the most common contracting strategy in use today, and could be used if:

- The Authority were seeking the lowest initial capital cost as exhibited by low bid and, the project were not schedule-sensitive
- Major changes to the project were unlikely due to the completeness of the plans and specifications, and creativity (or best value) is not sought from proposers/bidders
- The Authority wants to exercise complete control over the design efforts, and thereby assume major portions of the risks (the Authority warrants the sufficiency of the plans and specifications to the contractor)
- The delay in knowing actual construction costs and cash flow requirements were not critical (low bid is not know until after construction bid opening. Re-bid may be required should the bids exceed the Authority's budget)

**CONSTRUCTION MANAGEMENT** at RISK was reviewed and deemed best if:

- The compression of the overall project schedule was important or the schedule is difficult to define
- The Authority needs to maintain a set budget number or needs to know the financial cost guarantee earlier in the process
- Early construction input was needed because the construction is expected to be difficult to manage, and the Authority also wishes to influence selection of equipment, material or subcontractors
- The Authority was looking to ultimately transition to D-B format; or an open-book and joint decision-making with contractor is desired

**The DESIGN-BUILD** procurement and contracting approach is believed best if:

- The Authority were seeking potential cost reductions (the D-B contractor performing the design has a better feel for the constriction cost of various alternatives (i.e., value engineering occurs throughout the proposal process)
- Shortened project completion timeframes were desired (fast-track construction is possible)
- Reduced exposure to claims was desired (the D-B entity is responsible for preparing the plans and specifications and may also be responsible for differing site conditions)
- The Authority was looking for innovation and incorporation of new technologies, possibly through paying a stipend to get the intellectual property and creative design ideas from unsuccessful proposers to incorporate into the project
- The project had significant complexities and the Authority was seeking to assign the risk to an entity better able to manage it (eliminates contractor claims to the owner for field issues that result from design or constructability issues)

**PROGRESSIVE DESIGN-BUILD** is a variation on Construction Management at Risk and was considered:

- Progressive Design-Build is a relatively new design and construction management concept whereby the design and construction of the project are procured from a single entity primarily based on qualifications
- The selected design builder completes the design to between 30 to 60 percent and then submits a lump sum or guaranteed maximum price for the project to the Authority for approval.

- A significant feature of **Progressive Design-Build** contract is the fact that should the Authority and design-builder not be able to reach agreement on an acceptable price, the Authority could then:
  - Negotiate with another qualified design-build team, or
  - Take the partially completed design and use it as the basis for completing the design, or
  - Complete the design and proceed with a Design-Bid-Build procurement

**MULTIPLE PRIME CONTRACTS** as presented below were viewed as not being viable procurement and project delivery methods for this project for the following reasons:

- Multiple Prime contracts are typically used on vertical construction where an owner divides the project in parts or phases and enters into separate contracts for each part or phase (e.g., site development, excavation, structural, mechanical, electrical).
- Additionally, multiple prime contracts require careful coordination because multiple contractors are involved, and no single contractor is responsible for the entire project.

**PERFORMANCE-BASED** procurement and project delivery is a variation of Design-Build designed to streamline the procurement cycle. Performance Based procurements efforts focus their efforts on defining the purpose of the work to be performed, as opposed to either the manner in which the contractor must perform the work or the means and methods that must be used by the contractor.

- Performance-based contracting holds the Authority accountable for establishing clear performance expectations and the contractor accountable for achieving those expectations.
- With the performance-based design-build procurement, the Request for Proposals generally does not include design drawings. But rather it sets forth standard construction specifications to establish minimum quality standards and focuses as much as possible on, measurable performance criteria or objectives, rather than on specific design approaches to achieve those objectives. Allowing for creativity while providing the Authority with access to the innovative and cost-effective commercial services or products.

With careful planning and good management some inherent risks in the project development process can be substantially reduced or virtually eliminated. The Authority's steps towards achieving this goal include:

- Incorporating a thorough and realistic appraisal of the project concept and scope, conducting a realistic estimate of time and costs for the defined scope and quality, and making contingency allowances where scope or work is uncertain
- Development of a sound procurement strategy designed to optimize performance that is supported by the appropriate organization structure and responsibility distribution. This effort includes:
  - Examining the contract documents for risk, clarity and potential sources for misunderstanding
  - Seeking innovative but practical solutions to offset potential risk areas
  - Recognizing that risk and reward go together
  - Preparing contingency action plans and work-arounds
- The Authority will also use more traditional performance bonding to create incentives for its contractors to fulfill the contractual obligations. If such obligations are not met or fulfilled, then the Authority would seek payment for damages under the performance bond

As presented herein, the appropriate design and construction procurement strategy selection depends on the type of project; its particular emphasis on scope, quality, time and cost, and the degree of uncertainty associated with each. The Authority's approach to risk management consists essentially of four process phases, namely:

| | |
|---|---|
| **Phase-I** | Risk Identification |
| **Phase-II** | Risk Assessment |
| **Phase-III** | Risk Response |
| **Phase-IV** | Action Documentation |

**Therefore, the selection of the right contract requires:**

- The identification of specific risks
- Determination of how they should be shared between parties, and
- The insertion of clear language in the contract documents to put it into effect.

## Unpredictable Events

Though impossible to predict, it's worth mentioning the threat of significant events, such as natural disasters that, if they occurred, could delay or stop the high-speed train project. A large-scale earthquake or historic wildfire that destroys significant amounts of existing infrastructure could divert state and local infrastructure investment funding toward repair and rebuilding and away from new projects such as high-speed rail.

The Authority does not have plans to prevent such a disaster, and in such an event would support rebuilding and repairing California's existing infrastructure as a priority over high-speed rail development.

# Oversight

## Project Oversight and Controls

### Authority Board and Appointments

The Authority's nine-member Board of Directors is the main, regular oversight of the Authority's activities. The appointment of Board members is made by a trio of entities – the governor (5 appointees), the Assembly (2) and the Senate (2). This body provides the first level of public transparency and accountability. The Board is subject to California's open public meetings laws; therefore, the Authority's monthly Board meetings, agenda and notice requirements, along with the opportunity for public participation and comment at those meetings, complement the appointment procedures and responsibilities and provide a transparent view of the project's progress, policies and administration.

### Legislation and Initiatives

The high-speed train project and the actions of its Board, staff and contractors are controlled and governed by a series of legislatively enacted statutory provisions, both general and specific to the project, and the extensive requirements of the voter-approved Proposition 1A.

Senate Bill 1420 (1996), the Authority's enabling statute, and subsequent legislative vehicles charge the Authority with developing and implementing intercity high-speed rail service that is fully integrated with the existing intercity rail and bus network, commuter and rail transit lines and other transit services at common facilities. As prescribed in the statutes, the Authority previously submitted a number of feasibility, business and financial plans to the Legislature. It also prepared and crafted, with the Legislature and Governor Schwarzenegger, a plan for the construction and operation of a high-speed train system in the form of Assembly Bill 3034, that was placed before and approved by state voters in November 2008 as Proposition 1A (Prop. 1A).

### Proposition 1A

Prop. 1A is comprehensive and prescriptive in terms of oversight and accountability of the state's high-speed train project. By the proposition's enactment by state voters, Prop. 1A establishes a host of mandatory financial, service, regulatory and review procedures and requirements.

The Authority must establish an independent peer review group to analyze and comment on the elements of the individual

The California High-Speed Rail Authority and the state's high-speed train project are subject to a comprehensive system of external controls, oversight and review – more so perhaps than any other capital or construction project in the history of the state. Over the 13-year life of the Authority and its work in developing the train project, there has been and continues to be more analysis, discussion and review of the project than that of any other single or comparable large-scale public transportation project in the state. The uniqueness and enormity of the project, make this scrutiny appropriate and provide greater assurance that the public's interest will be protected and that the project's success will be realized.

corridor funding plans, with specific members of the eight-person peer review group designated by the state Treasurer; the Controller; the Director of Finance; and the Secretary of Business, Transportation and Housing.

Ninety days before submitting an initial request to the governor and the Legislature for bond funds to pay the capital costs on a project segment, Proposition 1A requires that the Authority must first approve and submit a detailed funding plan for the corridor to the Director of Finance, the peer review group, and the transportation policy and fiscal committees of the Legislature. The plan must include myriad specific items and project information for legislative and administrative review (subject to an exception for certain limited costs). The Authority also must submit a second funding plan to the Director of Finance and the Joint Legislative Budget Committee that covers topics and project items similar to those in the first report plus any material changes in that report's information since its submittal. In addition, the Authority must provide a report by an independent firm or firms verifying that the project can be constructed as proposed. Only after the Director of Finance finds that the plan is likely to be successful can the Authority commit funds for construction and real property and equipment acquisition (subject to an exception for certain limited costs). Finally, the Authority must inform the governor and the Legislature of any material changes in the plan that would jeopardize its success.

## Budgetary Oversight

Oversight of the Authority and the high-speed train project extends to the annual state budget process and involves a collection of control entities, including the Department of Finance (DOF), Governor's Office, Legislative Analyst's Office (LAO) and the Budget Committees of the Legislature.

Like other state agencies, the Authority annually must prepare a proposed budget for the next fiscal year, accompanied by a program of work activities for review and approval by the DOF and inclusion in the governor's proposed budget in January. The budget's release is followed by the preparation and publication of the LAO's analysis and recommendations on the Authority's proposed expenditures and work programs. Subsequently, the respective budget subcommittees of the two houses conduct hearings on the budget and the LAO's recommendations before taking action on an appropriation amount and potential controls on the expenditure of the budget funds. These actions may be repeated in some measure after the release of the governor's May Revise of the original budget proposal.

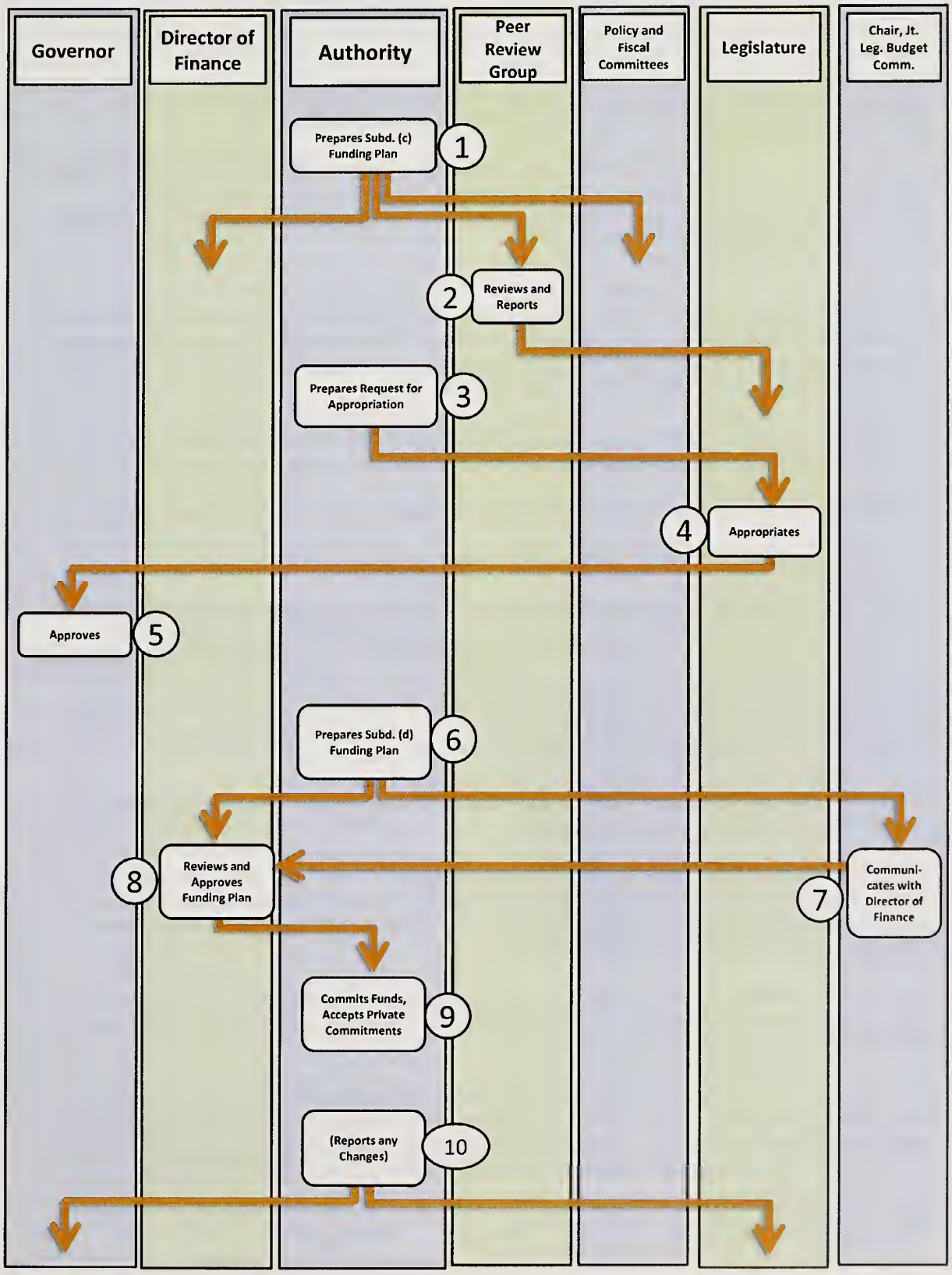
The Legislature exercises further collective oversight of the Authority's finances through the Budget Conference Committee, which considers and resolves any differences in the two houses' recommended budget actions. The conference body produces a final budget that in turn must be approved by both houses of the Legislature and ultimately be submitted to the governor for final review and approval, including possible reductions in the Authority's individual appropriation.

## Legislative Policy and Fiscal Oversight

The Authority is also subject to review by the standing policy and fiscal committees of the Legislature which exercise their own oversight and assessment of the Authority's operations. Informational and oversight hearings of the transportation policy committees especially provide forums for focused and in-depth supervision of the high-speed train project's progress.

There are special select committees on transit and rail that conduct their own meetings and inquiries and the operations of the Joint Legislative Audit Committee that also serve to monitor the progress of the state's high-speed rail development. In addition to such examinations, the several committees regularly request and are provided specific information or responses to written and verbal inquiries about the Authority's operations and project activities.

## FUNDING PLAN REVIEW AND APPROVAL PROCESS



The Peer Review Group, described in Public Utilities Code section 185035, reviews the corridor funding plans which the Authority must prepare and that must be submitted to the Peer Review Group at least 90 days before the Authority makes its initial request for an appropriation of bond proceeds. (Sts. & Hwys C. sec. 2704.08, subd. (c).) However, the Authority must prepare a second corridor funding plan, which must then be approved by the Director of Finance, prior to committing the bond proceeds. (Sts. & Hwys C. sec. 2704.08, subd. (d).)

The chart is based on (1) provisions contained in the above-cited sections, (2) inferences drawn from those provisions, and (3) other provisions of law governing the appropriation process.

1. The Authority must submit its first funding plan for a corridor or usable segment thereof (the "subdivision (c) funding plan") to the Peer Review Group, to the Director of Finance, and to the Policy and Fiscal Committees at least 90 days before the Authority submits its initial request for an appropriation. (Sts & Hwys C. section 2704.08, subd. (c)(1).)

2. "The peer review group shall evaluate the authority's funding plans and prepare its independent judgment as to the feasibility and reasonableness of the plans, appropriateness of assumptions, analyses, and estimates, and any other observations or evaluations it deems necessary." (Public Utilities C. section 185035, subd. (c).) "The peer review group shall report its findings and conclusions to the Legislature no later than 60 days after receiving the plans." (Public Utilities C. section 185035, subd. (e).)

3. The Authority submits an initial request for appropriation to the Legislature and to the Governor at least 90 days after the subdivision (c) corridor plan is submitted. (Sts & Hwys C. section 2704.08, subd. (c)(1).)

4. By operation of law, the Legislature appropriates the requested bond proceeds (or chooses not to do so).

5. By operation of law, the Governor approves the appropriation (or chooses not to do so).

6. Even after the bond proceeds have been appropriated, the Authority cannot commit the funds, nor can it accept commitments from private parties. Instead, it must first prepare another corridor funding plan (the "subdivision (d) funding plan") which it submits to the Chairperson of the Joint Legislative Budget Committee and to the Director of Finance. The plan is accompanied by reports, "prepared by one or more financial services firms, financial consulting firms, or other consultants," concerning the viability of the plan. (Sts & Hwys C. section 2704.08, subd. (d).) These firms or consultants must be "independent of any parties, other than the authority, involved in funding or constructing the high-speed train system." (Ibid.)

7. The Joint Legislative Budget Committee can communicate with the Director of Finance if it chooses to do so. (Sts & Hwys C. section 2704.08, subd. (d).)

8. The Director of Finance reviews the subdivision (d) funding plan within 60 days after it is submitted, considers any communications received from the Joint Legislative Budget Committee, and determines whether "the plan is likely to be successfully implemented as proposed." (Sts & Hwys C. section 2704.08, subd. (d).)

9. If the Director determines that "the plan is likely to be successfully implemented as proposed," the Authority may commit bond proceeds and accept offered commitments from private parties. (Sts & Hwys C. section 2704.08, subd. (d).)

10. "Subsequent to approval of the detailed funding plan required under subdivision (d), the authority shall promptly inform the Governor and the Legislature of any material changes in plans or project conditions that would jeopardize completion of the corridor as previously planned and shall identify means of remedying the conditions to allow completion and operation of the corridor." (Sts & Hwys C. section 2704.08, subd. (e).)

Note: The above-described process does not apply to up to 7.5% of bond proceeds used for certain specified purposes. See Sts & Hwys C. sec. 2704.08, subdivision (g).

Finally, the policy and fiscal committees provide review and oversight during hearings on individual legislative measures when such bills come before the committees for consideration and action.

## Control Agency Review

The Authority's operations and project work are conducted under the usual supervision of a number of state control agencies, the same regulation and administration as that for other state departments and entities. In addition to the budget-approval and monitoring role of the Department of Finance, the Authority must adhere to the various legal procedures and requirements administered by the Department of General Services (contracts), State Treasurer's Office (bond requirements), Department of Transportation (personnel), State Controller's Office (claims and payments), and so on. The Attorney General provides legal oversight and counsel on myriad Authority matters and activities and as previously mentioned, the State Auditor provides formal audit supervision and review as approved through the Joint Legislative Audit Committee.

## Peer Review

AB 3034 created an eight-member independent peer review group to review the planning, engineering financing and other elements of the Authority's plans, and will provide the Legislature with an analysis of the appropriateness and accuracy of the project's assumptions and the plan's viability. The Treasurer, Controller, Director of Finance, Secretary of Business, Transportation and Housing are responsible for designating specified members of the peer review group according to the expertise and experience requirements in AB 3034. Other peer review arises from the exchange of information and consultation with the Authority's numerous international partners under memoranda of understanding with other countries' federal transportation, and rail (including high-speed train) ministries, as well as those for development, energy, ecology, and infrastructure, etc. The agencies, and private rail-related companies associated with the various government entities, provide a steady stream of evaluation and expertise to the Authority staff and the board members to foster and facilitate the successful development of the California high-speed train project.

## Ongoing/Future Reporting Requirements – SB 783

The Authority and the high-speed train project will continue reporting to the Legislature as a result of the enactment of Senate Bill 783 (Ashburn, 2009). SB 783 requires the Authority to prepare, publish, adopt and submit to the Legislature after public hearings, additional business plans beginning January 1, 2012 and every two years thereafter. Like the current plan, the future reports will address the finances, patronage, right-of-way acquisition, environmental clearances, construction, equipment, operations and a host of additional subjects that comprise the project and its implementation.

**At present time, only three slots on the eight-member review group are filled. Those members are John Chalker, Founder of LM Capital Group, LLC; Lou Thompson, Principal of Thompson, Galenson & Associates, LLC; and Will Kempton, CEO of the Orange County Transportation Authority.**

## Program Management Oversight and Local Agreements

The Authority is committed to further professional and expert oversight through the retention of an independent program management oversight (PMO) team. The PMO reports directly to the Authority and is responsible for monitoring and reviewing

the performance of the program manager (Parsons Brinckerhoff), determining the PM's compliance with the agreed project budget, services and schedule objectives and assessing the appropriateness of procedures and methods used to implement and complete the project.

The Authority also has a growing number of local cooperative agreements that provide a means to ensure the consideration and implementation of the best project alternatives in each community served by the high-speed train project. The agreements enunciate objectives, establish working groups, and enumerate tasks and responsibilities to share and coordinate the Authority's and local agencies' respective resources toward implementation of a phased joint program of high speed rail and commuter rail rapid transit services. The agreements serve to provide cooperation and coordination as well as adequate oversight and the effective use of available financial and personnel resources in each project area.

## Recovery Act Oversight

Additionally, the awarding of American Recovery and Reinvestment Act (ARRA) funding triggers an extensive series of reporting and oversight requirements prescribed by the federal government. The Authority anticipates being awarded a portion of the $8 billion set aside within the ARRA for high-speed intercity rail. That will necessitate that the Authority submit detailed reports not just to the Federal Railroad Administration and the U.S. Department of Transportation, but also be subjected to oversight by the federal Government Accountability Office and congressional committees and subcommittees.

The California Governor's Office has established a Recovery Act Task Force, and the Authority would also have to report to that entity, with another vigilant layer of oversight in the Office of the Inspector General, a position created by Governor Schwarzenegger to watchdog stimulus funds in California and ensure they are spent appropriately.
Other steps will be taken to maintain transparency and offer opportunity for on-going oversight:

- Public meetings
- Weekly executive summaries
- Posting of materials/documents on Web site
- Consultation with legislative staff

## Conclusion

This document serves as a snapshot in time of a dynamic project that will continue to evolve as it moves from one phase to the next. It shows that the state's high-speed train project is on track, and that it has gained additional momentum in recent months.

The Authority is committed to regularly updating this document to ensure legislators and the general public are informed about the progress and changes to the plan to design, build and operate a high-speed rail system in California.

Outside of this document, the Authority is committed to frequently updating the public and the Legislature on the project's progress, which it will do through a variety of means, including regular email communication, its Web site, public meetings and more.

A high-speed rail system is needed in California. As Proposition 1A shows us, it is wanted in California. Examples from around the world tell us such a system is viable here. And building such a system will bring hundreds of thousands of jobs now, when our state and economy need them most.

For additional updates and information on the California High-Speed Train Project, please visit the Authority's Web site at

**www.cahighspeedrail.ca.gov**

or contact the Authority at

**California High-Speed Rail Authority**

**925 L Street, Suite 1425, Sacramento, CA 95814**

**or by telephone at (916) 324-1541.**

# AB 4x1 Checklist

## Below is language directly from the Budget Act of 2009 and the corresponding language, elsewhere in this document, responding to the bill language.

Assembly Bill 1 from the 4th extraordinary session of the state Legislature, the Budget Act of 2009, requires that the Authority submit … *a revised business plan to, and a 30-day review by, the Joint Legislative Budget Committee that, among other things, addresses, at a minimum:*

- ***a plan for a community outreach component to cities, towns, and neighborhoods affected by this project,***

☑ "Between today and the commencement of construction, there will be ample and significant opportunities for public input and interaction. These opportunities are detailed in the section below."

(From Section "Outreach," Page 53)

☑ "Ogilvy Public Relations Worldwide was chosen in November as that new contractor, and is expected to begin work with the Authority in January 2010."

(From Section "Outreach," Page 54)

☑ "To achieve its outreach goals, the Authority employs a number of tools, outlined below."

(From Section "Outreach," Page 54)

☑ "Additionally, the Authority's program management team has committed to training its regional managers in Context Sensitive Solutions, an outreach tool being employed with the communities in the Bay Area's Peninsula that is a collaborative, interdisciplinary approach that ensures input from all stakeholders. By ensuring that the high-speed rail project's regional managers are trained in this collaborative public engagement mindset, the Authority believes outreach efforts will improve in quality."

(From Section "Outreach," Page 56)

- ***further system details, such as route selection and alternative alignment considerations,***

☑ "The environmental process for each of the high-speed train project sections in both initial and subsequent phases has been initiated. The status of the work prepared for each section as of December 1, 2009, is shown in the exhibits below and summarized as follows."

(From Section "From Today to Passenger Service," Page 29)

- ***a thorough discussion describing the steps being pursued to secure financing,***

☑ "New funding sources, specifically for high-speed rail, along with the expansion of existing transit programs, will need to be created in order to provide adequate support for the high-speed train. Project proponents argue that a focus on investing in America's overall transportation system, as opposed to individual modal investments, would encourage more efficient allocation of transportation dollars and likely increase the proportion of funding provided for rail projects. As mentioned above, short term funding for high-speed trains is anticipated through the annual transportation appropriations process as a new transportation authorization has yet to come to the floor. The surface transportation reauthorization provides the opportunity for the Authority and other states developing high-speed rail to seek a long-term dedicated funding source. In fact, the Authority has already begun to advocate for dedicated federal funding for high-speed trains, working with members of California's congressional delegation.

(From Section "Paying for the System," Page 97)

☑ "Expansion of existing federal funding programs, as well as significant new initiatives, will be required to support California's high-speed train at the levels assumed in this financing plan. Modification of existing federal financing terms and restrictions also would make the project more attractive to private investors, thereby facilitating achievement of the targeted private sector funding levels, as well."

(From Section "Paying for the System," Page 98)

☑ "The Authority plans to develop plans to solicit and develop a process for formalizing local support over the next several months."

(From Section "Paying for the System," Page 99)

☑ "One way for local governments to realize significant local revenues from real estate appreciation along the alignment is through Transit-Oriented Development (TOD). TOD would allow local governments to benefit from the development of high-speed trains with increased real estate tax revenues from increased density without burdening the balance sheets of local governments. The Financial Plan presumes that the Authority would work closely with each local agency to explore and adopt TOD agreements. ... In addition to TOD, the implementation of publicly established benefit assessment districts and the Mello Roos districts near a transit or rail facility are alternative ways to raise development-related revenues that can be financed."

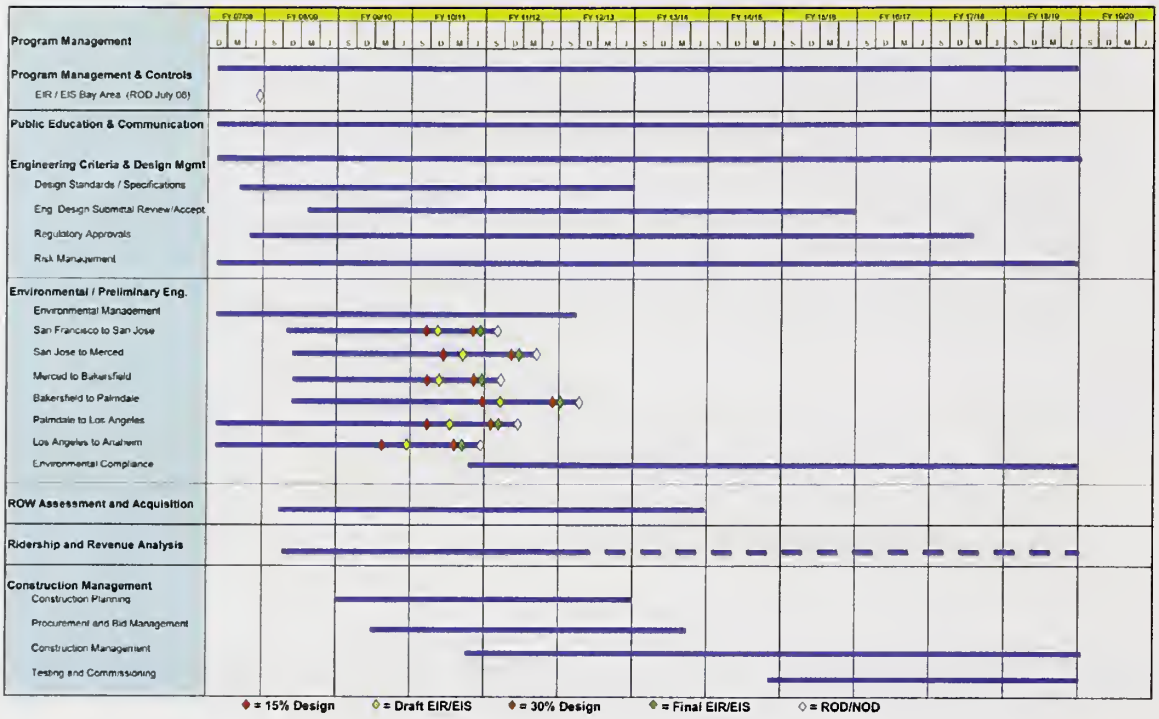
(From Section "Paying for the System," Page 99)

☑ "Commercial concessions at stations are important tools to realize additional locally generated revenues. These concessions include retail stores, advertising, parking, and other commercial revenues. The Financial Plan presumes that the Authority would work closely with appropriate local agencies to explore and adopt station commercial concessions before stations are built."

(From Section "Paying for the System," Page 100)

- *a working timeline with specific, achievable milestones , and*

☑ "San Francisco – Anaheim Master Summary Schedule – Program Management Activities




(From Section "From Today to Passenger Service," Page 51)

- ***what strategies the authority would pursue to mitigate different risks and threats .***

☑ "A project of this size, scope and nature faces a number of risks that could jeopardize its completion. Any frank discussion of the project and its planning must include these risks, and any credible plan for the project must address how these risks would be mitigated. This section describes those risks in a frank manner and notes the manner in which the Authority plans to mitigate them. General categories of risk include funding, politics, litigation, federal regulations, construction, and unpredictable events."

(From Section "Risks and Mitigation," Page 119)

- ***The revised business plan shall also provide additional information related to: funding ,***

☑ "The following financial plan will outline each of the various funding sources with details on the Authority's financial assumptions. This includes $9 billion from state funds, available through the Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century, approved by California voters as Proposition 1A in 2008. The Authority is also seeking approximately $17-$19 billion in federal funding. Part of the overall federal input includes the American Recovery and Reinvestment Act (ARRA) based on the Authority's recently submitted an ARRA application totaling

$4.7 billion for four different construction sections and additional environmental and engineering funds. The Authority is targeting $4-$5 billion in local support and through such public-private partnerships (P3s) such as transit-oriented development, parking concessions and naming rights opportunities.

From Section "Paying for the System," Page 92)

☑ "As demonstrated in the previous section on ridership and revenue, the initial San Francisco-to-Anaheim portion of the project is expected to generate significant operating surpluses even after accounting for operations and maintenance costs and renewal and replacement reserves. This dedicated and significant revenue stream after full San Francisco-to-Anaheim operation begins will provide the Authority with an opportunity to seek innovative P3s to provide capital funding to help complete the system. The Authority is targeting $10-$12 billion in P3 funding."

(From Section "Paying for the System," Page 92)

- ***project development ,***

☑ "The environmental process for each of the high-speed train project sections in both initial and subsequent phases has been initiated. The status of the work prepared for each section as of December 1, 2009, is shown in the exhibits below and summarized as follows."

(From Section "From Today to Passenger Service," Page 29)

- ***schedule,***

☑ "The following Master Summary Schedule for the San Francisco to Anaheim portion of the CHSTP is split in two parts: program management activities and right-of-way acquisition and construction activities. Together they show major program management activities and currently projected timelines for the regional project-level environmental review/preliminary engineering, target NOD/ROD milestones, procurement activities, final design/construction durations, testing/acceptance, and pre-revenue operations leading to the start of initial revenue service in 2020."

(From Section "From Today to Passenger Service," Page 51)

- ***proposed levels of service,***

☑ "In order to prepare a ridership and revenue forecast, a schematic operations plan is needed, providing how often trains will run, which stations they will stop at, and how long they take between station stops. This is done both for the peak morning and afternoon travel times, and for an off-peak period for the remainder of the day. Table A shows the schematic operations plan developed from ongoing ridership and operations planning for the initial phase of service in the peak period southbound. The northbound service plan mirrors the southbound."

(From Section "Ridership, Revenue & Operations," Page 66)

- ***ridership,***

☑ "Riders and revenues are presented below for the year 2035, as well as for start-up in the year 2020."

(From Section "Ridership, Revenue & Operations," Page 65)

- *capacity,*

☑ "This forecast and operating plan for an initial phase of service between Anaheim and San Francisco are based on using single-level trainsets either singly with 450-500 seats each or two sets coupled together with 900-1,000 seats. In the year 2035, 270 trains operate throughout the day, in a mix of express non-stop service and shorter-distance limited service."

(From Section "Ridership, Revenue & Operations," Page 65)

☑ "A total of 65 trainsets are needed to handle the service, before accounting for second sets, spare sets to provide service in case of mechanical problems, and out-of-service maintenance needs. The next step was to determine how many trains required the doubling of capacity by coupling a second trainset."

(From Section "Ridership, Revenue & Operations," Page 76)

- *operational plans,*

☑ "This peak schematic pattern provides 57 trains in each direction in 6 hours, for an average of just under 10 trains per hour. The off-peak for the initial phase of service provides 71 trains in each direction over a 10-hour period, for an average of 7 trains an hour."

(From Section "Ridership, Revenue & Operations," Page 66)

☑ "The detailed operations plan incorporates the schematic operating pattern shown earlier for ridership forecasting. The types of trains in the pattern (express, local, limited stop) were arranged into a repeating hourly "clock-face" pattern to make the service more regular and predictable, and to reduce the number of different kinds of overtakings (i.e. express trains passing limited trains) that would be required. The minimum time between trains following each other past a given point was set at three minutes, based on the practical capacity of the signal and train control system. Overtakes were arranged at intermediate stations, with local stopping trains pulling off the main track to the platform, allowing the non-stop train to pass. Although stations stops were swapped among some of the local and limited stop trains to make the schedule work better, the service levels between station pairs were kept at the same level. Figure 3 shows a typical morning peak hour of the detailed operational timetable, running south from San Francisco Transbay and the spur from Merced joining the main line north of Fresno."

(From Section "Ridership, Revenue & Operations," Page 74)

☑ "Table H - Key operations parameters Initial Phase, 2035, HST fares 83% of air"

(From Section "Ridership, Revenue & Operations," Page 79)

☑ "Figure 8 - Operations cost by year – Initial Phase (2009$$)"

(From Section "Ridership, Revenue & Operations," Page 80)

☑ "Table I - Initial Phase Operating cost by category, 2035, HST fares 83 % of air"

(From Section "Ridership, Revenue & Operations," Page 81)

☑ "Table J - Initial Phase Operating Results, 83% of air fares, Year of Expenditure $$"
(From Section "Ridership, Revenue & Operations," Page 82)

- ***cost,***

☑ "The following section will for the first time describe the estimated cost of the project in year-of-expenditure (YOE) dollars, as was required in the application for American Recovery and Reinvestment Act funds, and as compares to the $9 billion in bond funds made available by the passage of Proposition 1A. This way of preparing the estimate provides a more credible view of the cost of the project in the year in which it is expected to be constructed, and the projected cash flow by year.

(From Section "Cost of the System," Page 84)

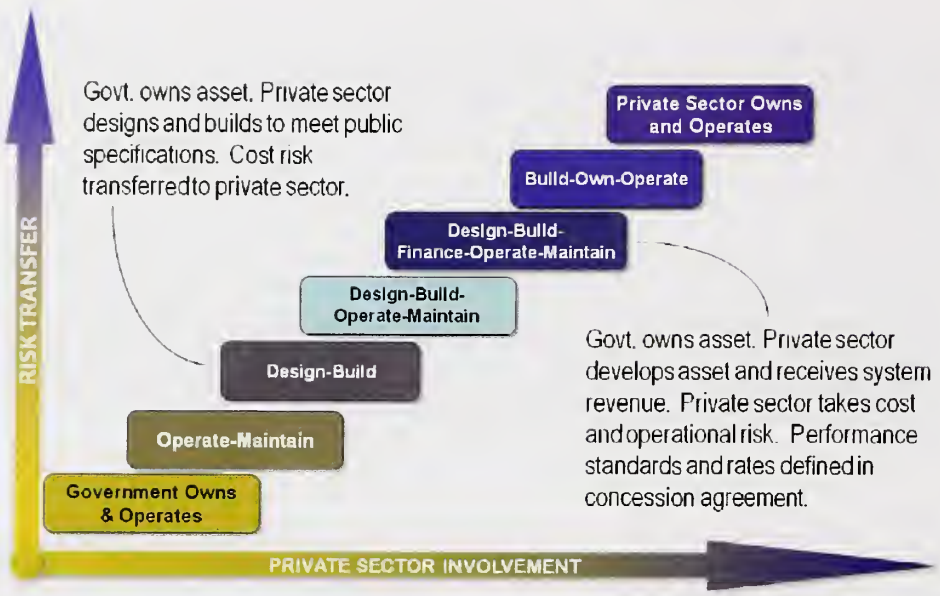
☑ "The updated cost estimate for the San Francisco-to-Anaheim initial high-speed rail system in current year dollars is $35.7 billion. This reflects inflation costs between 2008 and 2009, as well as section cost updates. Adjusting the project cost for YOE dollars brings an updated cost estimate of $42.6 billion. Almost 80 percent of that cost change is attributable to inflation. In other words, only about 20 percent of the estimated cost increase (about $2.3 billion) is due to real cost growth due to refinements in estimated unit costs and updated quantities attributable to updated section configurations and to other revisions described below."

(From Section "Cost of the System," Page 84)

- ***private investment strategies,***

☑ "One of the ways the Authority would like to leverage public funds for this project is through pursuing public-private partnerships. High-speed rail, unlike most transit services, is expected to generate significant operating surpluses. These operating surpluses are the basis for the Authority's plans to engage private sector support. Private funding through public-private partnership arrangements is an increasingly accepted method to support the development of infrastructure projects. Based on this premise, the Authority's Financial Plan is targeting $10 to $12 billion (in year of expenditure dollars) from potential private sources for the San Francisco-to-Anaheim segment. This investment is primarily backed by the high-speed rail's projected future operating surpluses as well as some type of revenue guarantee and is based on a level of risk and capital markets terms that the team believes are appropriate for this type of project. To gain a better understanding of private interest in the project, the Authority issued a Request for Expressions of Interest (RFEI) in the Spring of 2008. Since that time, the Authority has continued to reach out to private industry leaders with experience in High Speed Rail and other large infrastructure projects. Results of the RFEI have shown that private sector interest is strong and diverse; however, public support, both financial and political, is needed to generate private funding commitments."

(From Section "Paying for the System," Page 101)




(From Section "Paying for the System," Page 102)

☑ "Over the past two years, the Authority has undertaken extensive work to gauge and encourage private sector interest in the High Speed Rail project. In March 2008, the Authority issued a Request for Expressions of Interest ("RFEI"). The purpose of the RFEI was to gain a better understanding of how the Project could benefit from private sector participation and to gauge the level of private interest in the Project. ... Since the RFEI in 2008, the Authority has continued to reach out to the private sector to gauge interest in the project as well as seek guidance on technical and procurement issues. ... The Authority is once again planning to consult the private sector as it moves forward with the beginnings of a procurement process in 2010."

(From Section "Economy/Climate Right Now," Page 111)

- ***staffing, and***

☑ "To date, the California High-Speed Rail Authority has been a planning organization, staffed by a small number of state employees, relying largely on contract services, and governed by a nine-member board of directors. However, now the Authority must transform into an implementation entity responsible for what will be the largest public works infrastructure project in state history. This section describes the current organization and the steps necessary to grow it into a state entity overseeing construction of the state's high-speed train system."

(From Section "The High-Speed Rail Authority," Page 9)

- ***a history of expenditures and accomplishments to date.***

☑ "Over the course of its 13-year history, the Authority's budget has varied and has come from a variety of funds, including those from regional partner transportation agencies. Below is a chart showing the Authority's funding since its inception, the sources of those funds, and the activities on which they were expended."

(From Section "The Project and Its History," Page 8)

- [x] "The program-level EIR/EIS was certified in 2005."

  (From Section "The Project and Its History," Page 6)

- [x] "An additional program-level EIR/EIS was certified in 2008 that examined the path between the Central Valley and the Bay Area."

  (From Section "The Project and Its History," Page 6)

- [x] "San Francisco to San Jose Section: Scoping was initiated in December 2008. Three scoping meetings were held in San Mateo County, San Francisco, and Santa Clara County in January 2009."

  (From Section "From Today to Passenger Service," Page 30)

- [x] "San Jose to Merced Section: Scoping was initiated in March 2009. Scoping meetings were held in San Jose, Merced, and Gilroy in March 2009."

  (From Section "From Today to Passenger Service," Page 32)

- [x] "Scoping was initiated in February 2009. Scoping meetings were held in Merced, Madera, Fresno, Visalia, and Bakersfield in March 2009."

  (From Section "From Today to Passenger Service," Page 33)

- [x] "Bakersfield to Palmdale Section: Scoping was initiated in September 2009. Scoping meetings were held in Bakersfield, Tehachapi, and Palmdale in September 2009."

  (From Section "From Today to Passenger Service," Page 35)

- [x] "Palmdale to Los Angeles Section: Scoping was initiated in March 2007. Scoping meetings were held in Los Angeles, Glendale, Sylmar, and Palmdale in April 2007. Since then, significant engineering and environmental work has been accomplished, including the evaluation of access into and out of Los Angeles Union Station."

  (From Section "From Today to Passenger Service," Page 36)

- [x] "Los Angeles to Anaheim Section: Scoping was initiated in March 2007. Three scoping meetings were held in Los Angeles, Norwalk, and Anaheim in April 2007. Working in cooperation with LA MTA, significant engineering and environmental work has been accomplished to identify and evaluate existing and future rail passenger and freight operations within the section, access into and out of Los Angeles Union Station (LAUS), design options for connecting with the planned Anaheim Regional Transportation Intermodal Center (ARTIC), a possible station in Fullerton, and alternative maintenance facility sites near LAUS and ARTIC. The AA process and the environmental technical reports have been completed."

  (From Section "From Today to Passenger Service," Page 37)

- [x] "Los Angeles to San Diego Section: Scoping was initiated in October 2009. Scoping meetings were held in La Jolla, San Diego, Escondido, Murrieta, Corona, Riverside, Monterey Park, West Covina, El Monte, and Pomona in October 2009 and also Ontario and San Bernardino in November 2009."

  (From Section "From Today to Passenger Service," Page 39)

☑ "Altamont Corridor Rail Project: … Scoping was initiated in November 2009, with sessions held in Livermore, Stockton, Fremont, and San Jose."

(From Section "From Today to Passenger Service," Page 40)

- ***AB 4x1 also states: In developing this revised business plan, the authority shall: work in consultation with the appropriate legislative policy committees and the Legislative Analyst's Office to respond to specific aspects in the plan .***

☑ Before beginning to develop this business plan document, staff from the Authority started by meeting with legislative staff to seek input and ideas. Through September and October, the team met with:

- Staff of both Senate and Assembly Transportation Committees
- Staff of both Senate and Assembly Budget/Fiscal Committees
- Staff to key interested legislators and legislative leadership
- The Legislative Analyst's Office
- The Governor's Office

Using input from those meetings, the team assembled an outline, which was circulated to the legislative staff and Governor's Office for further input and comments. Staff of the Authority continued to have e-mail dialogue with a number of legislative staff to continue to refine and gather input on the document.

CALIFORNIA HIGH-SPEED RAIL AUTHORITY

925 L Street, Suite 1425
Sacramento, California 95814
T (916) 324-1541
F (916) 322-0827

For additional information, visit the
California High-Speed Rail Authority's Web site at

**www.cahighspeedrail.ca.gov**

CALIFORNIA
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**BRIEFING: APRIL 2010 MEETING AGENDA ITEM #7**

**TO:** **Chairman Pringle and Authority Board Members**

**FROM:** **Carrie Pourvahidi, Interim Executive Director**

**DATE:** **3/31/10**

**RE:** **Transbay Transit Center Design / Trainbox**

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## Background

Authority staff and the Federal Railroad Administration directed the Program Management Team to review a number of concepts and drawings in recent weeks from the Transbay Joint Powers Authority's design consultants, Parsons Corporation.

The most recent of these drawings was submitted on March 9, 2010, and the PMT was asked to comment on its viability for use by high-speed trains. In particular, PMT was asked to evaluate whether, if the track layout was suitable for the high-speed trains, then would the trainbox shown on these drawings designed by Parsons under Phase 1 allow the necessary station platform and track layouts to be built.

PMT has completed its review, and have provided Authority staff with the attached memo outlining the review.

The track drawings supplied, with design variance as outlined in the memo, would be acceptable to receive the high-speed trains at the current planned level of service set for the Transbay Transit Center.

## Staff Recommendation

Accept the track design layout subject to the comments outlined in the attached memo.

**Attachments:**

- ✓ Memorandum dated 3/17/10 from Dominic Spaethling and Ken Jong to Tony Daniels.
- ✓ Drawings:
  - Alternative 3: Transbay Transit Center
  - Trainbox Blue Line Phase 1
  - Parsons End Platform Design
  - PB End Platform Design
  - Trainbox Red Line Phase 2

**Memorandum**

**To:** Anthony Daniels, CHSRA PMT Program Director

**CC:** John Harrison, CHSRA PMT Deputy Program Director

**From:** Dominic Spaethling, Regional Manager
Ken Jong, Engineering Manager

**Date:** 3/17/10

**Subject:** **Review of Transbay Transit Center Design of March 9, 2010**

The Engineering Management Team (EMT) has reviewed the drawing submitted by TJPA's design consultant Parsons Corporation on March 9, 2010. While the team did not conduct a comprehensive review of proposed station configuration and alignment, they were able to focus on three major components of the design:

- horizontal curve radii and the approach alignment
- distance required for the end stop
- and platform length, tangency and platform gaps.

Below is a summary of the initial findings by the team.

Horizontal Radius

Horizontal radius of 650-foot is commensurate with the tightest radii (622-foot / 190 m) that the EMT has found in revenue service at Cologne Central Station. This will require a design variance for it to be accepted as part of the HST system.

Approach Alignment

Alignment does not provide length of tangent track (75 foot) either side of platform needed to ensure swing of the cars do not require a tapered platform. In the absence of the tangent, we assessed platform tapers is all that is required. This will also require a design variance.

End Stop

In the absence of a design, the 40 foot length of track to allows for 30 feet inclusive of physical 'bumper' requirements plus a 10 foot distance from normal train parking position for end stop requirements. This 40 total distance would require a 3-5 mph operational speed.

Platform length

Platforms (23, 24, 25 or 26) meet the exceptional design criteria length of 1315 feet. The 1315 foot exceptional length does not provide for the TSI (European Technical Specifications for Interoperability) tolerance that permits train length to be increased 1% for aerodynamic design. A design variance will be required for the total length of the platforms.

Platform Gap

Platforms on tracks 23, 24, 25 and 26 will all require additional offsets due to the adjacent or proximate curves in the platform tracks. The beginning point of the need for additional car to platform clearance is based on the point at which the swing in the car body begins due to curvature, which is based on vehicle characteristics.

Since the CHSRA has not selected its vehicle type for the system, the EMT tested the vehicle / platform interface with two different trainset technologies. The acceptable gap between the vehicle and platform is governed by two requirements:

*Americans with Disabilities Act (ADA):* requires a maximum gap between platform and side of the train at door positions of 3 inches.

*CHSRA PMT Design Criteria:* The distance between the platform edge and the center of the nearest track is 5.75 feet inclusive of gap.

For the Shinkansen equipment, as a typical case, with the ADA standard offset of 3 inches:

Track 23: 82.5 feet into the platform, maximum offset at end: 10.1 total inches or a 7.1 inch additional gap.

Track 24: 108.9 feet into the platform, maximum offset at end: 6.7 inches or a 3.7 inch additional gap.

Track 25: 56.5 feet into the platform, maximum offset at end: 4.7 inches or a 1.7 inch additional gap.

Track 26: 29.1 feet into the platform, maximum offset at end: 3.7 inches or a 0.7 inch additional gap.

A design variance would be required for the potential platform gap issues.

In addition to the observations outlined above, the EMT would also need to confirm:

- Width of platform to be confirmed at 30 ft.

- Distance between face of platform and track centerline to be confirmed at 5.75 ft
- Superelevation
- Full approach with trackwork for consistency with the operational requirements.
- Operational mitigations (platform gap fillers, wheel lubrication devices, etc)

In conclusion, while the current design for the Transbay Transit Center would require a series of design variances in order for it to be acceptable for the HST system, the project, as currently described, can accommodate the planned level of service at the TTC. The appropriate next step would be to enter into a formal design variance process whereby the CHSRA and the TJPA can discuss the possible operational, design or other mitigations for the issues with the horizontal radius, approach alignment, platform length and platform gap. Finally, this terminal concept is only feasible if both Phase I and II as outlined in the plan set of March 9, 2010 are constructed before the initiation of service to the terminal. The Phase I construction alone would not be sufficient to accommodate the HST forecasted level of service.

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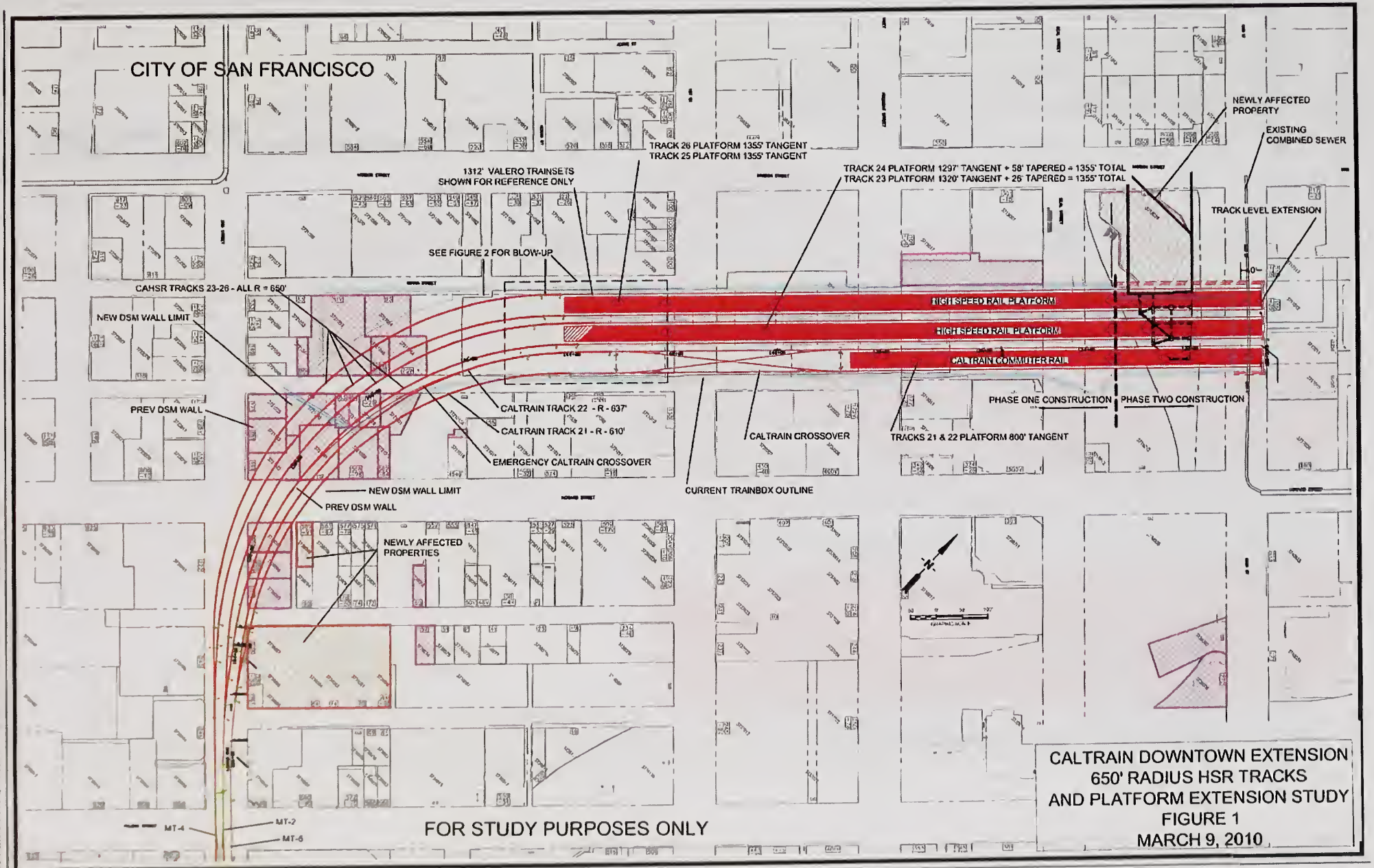
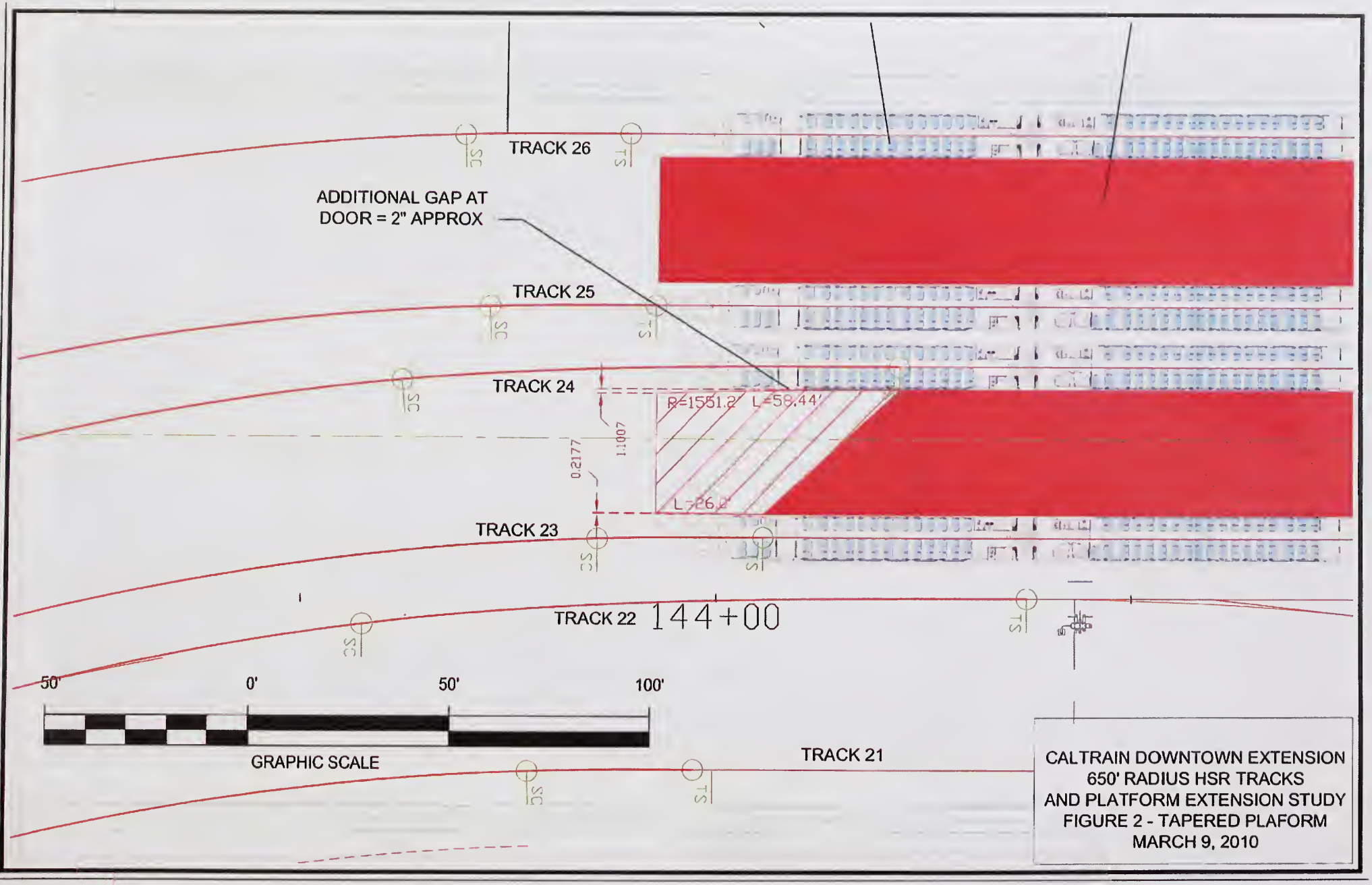
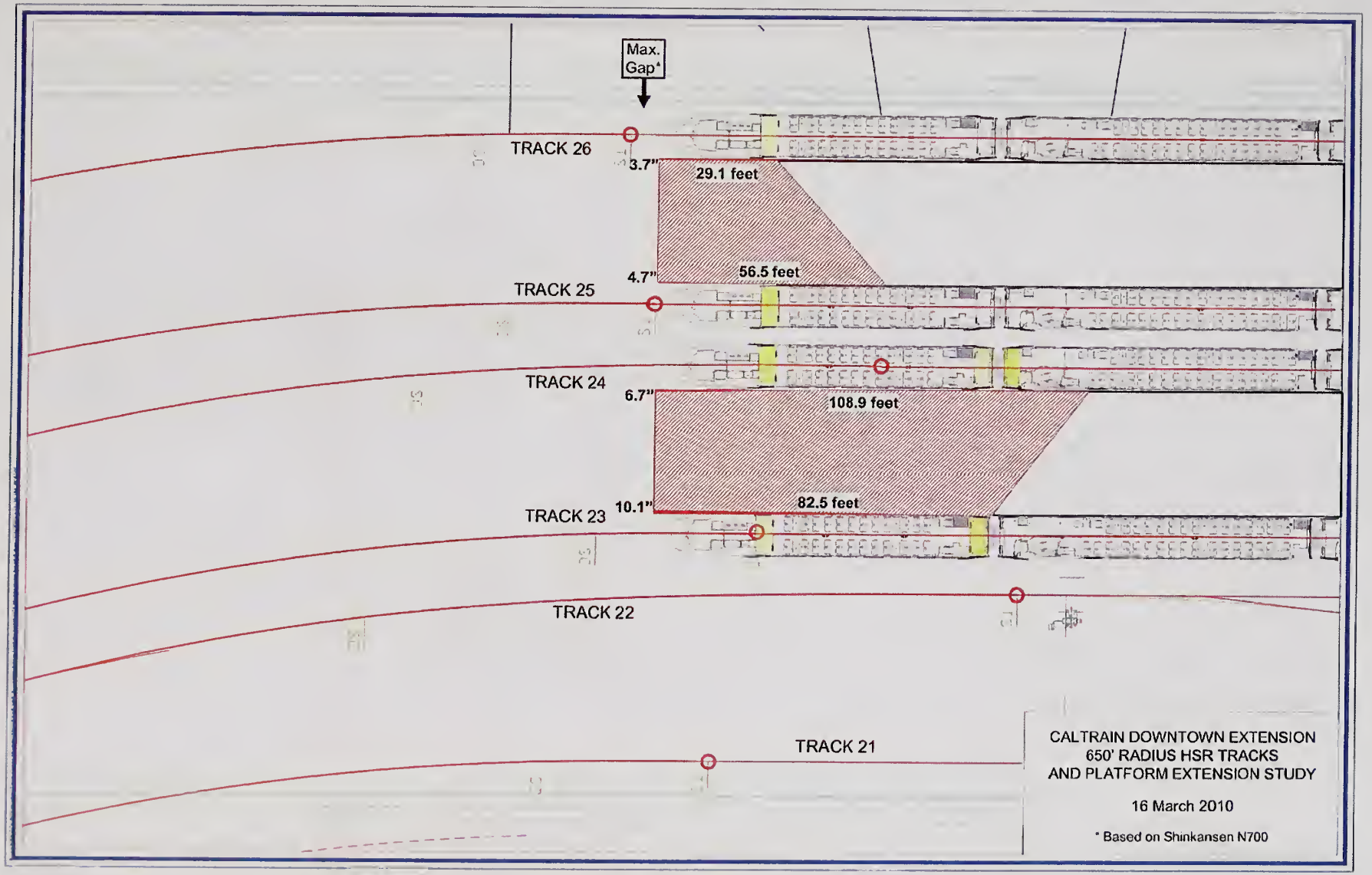
Without ever leaving the ground

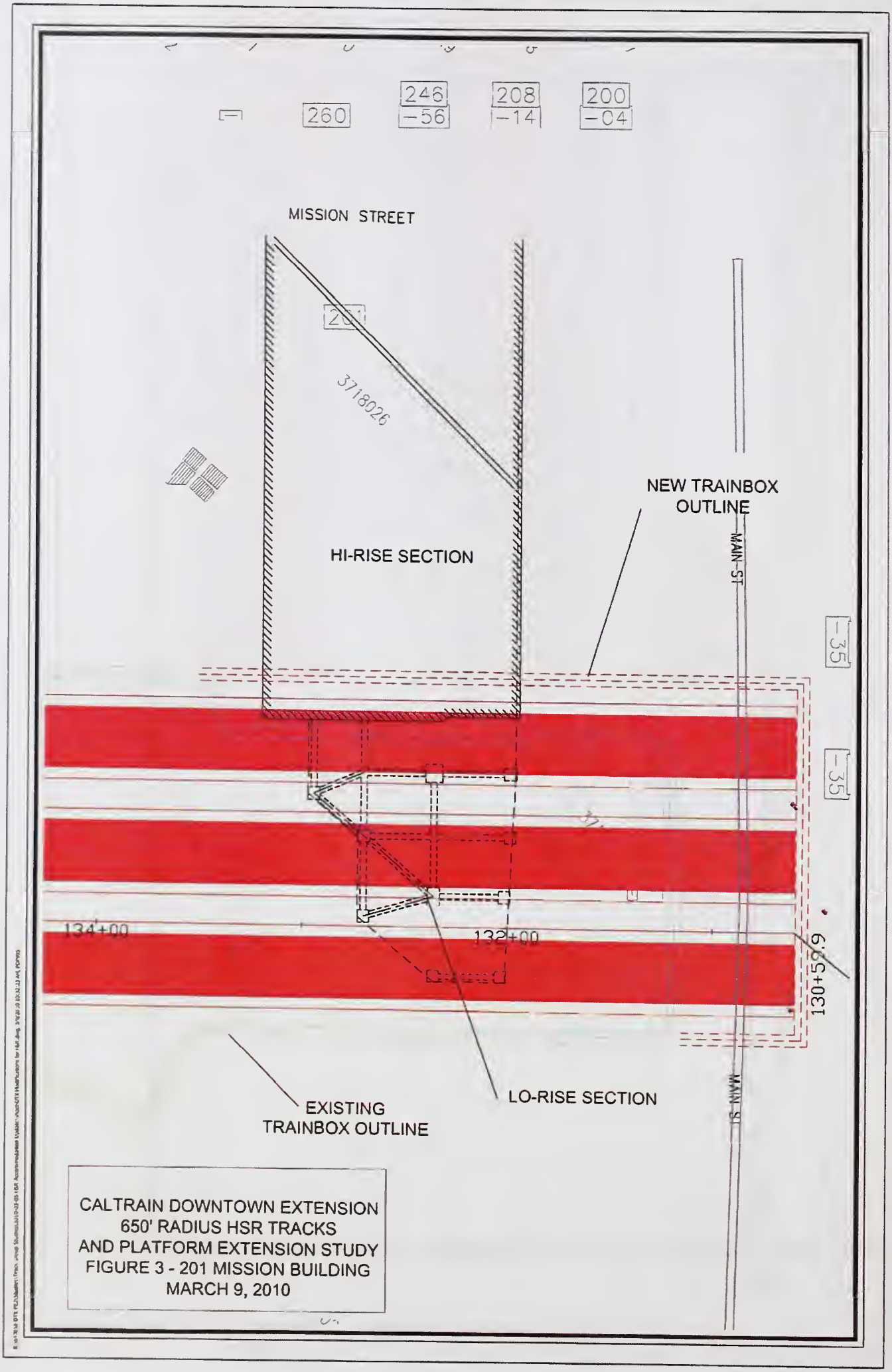
**CALIFORNIA HIGH-SPEED TRAIN PROJECT**
**SAN FRANCISCO**
ALTERNATIVE 3: TRANSBAY
TRANSIT CENTER
AA ALTERNATIVE OA
FIGURE 3

| | |
|---|---|
| CONTRACT NO. | XXX |
| SCALE | 1" = 300 |
| DATE | 03 24 10 |


CITY OF SAN FRANCISCO
TRACK 26 PLATFORM 1355' TANGENT
TRACK 25 PLATFORM 1355' TANGENT
1312' VALERO TRAINSETS SHOWN FOR REFERENCE ONLY
SEE FIGURE 2 FOR BLOW-UP
TRACK 24 PLATFORM 1297' TANGENT + 58' TAPERED = 1355' TOTAL
TRACK 23 PLATFORM 1320' TANGENT + 26' TAPERED = 1355' TOTAL
NEWLY AFFECTED PROPERTY
EXISTING COMBINED SEWER
TRACK LEVEL EXTENSION
CAHSR TRACKS 23-26 - ALL R = 650'
NEW DSM WALL LIMIT
HIGH SPEED RAIL PLATFORM
HIGH SPEED RAIL PLATFORM
CALTRAIN COMMUTER RAIL
PREV DSM WALL
CALTRAIN TRACK 22 - R - 637'
CALTRAIN TRACK 21 - R - 610'
EMERGENCY CALTRAIN CROSSOVER
CALTRAIN CROSSOVER
PHASE ONE CONSTRUCTION
PHASE TWO CONSTRUCTION
TRACKS 21 & 22 PLATFORM 800' TANGENT
NEW DSM WALL LIMIT
PREV DSM WALL
CURRENT TRAINBOX OUTLINE
NEWLY AFFECTED PROPERTIES
MT-4
MT-2
MT-6
FOR STUDY PURPOSES ONLY
CALTRAIN DOWNTOWN EXTENSION
650' RADIUS HSR TRACKS
AND PLATFORM EXTENSION STUDY
FIGURE 1
MARCH 9, 2010


TRACK 26
ADDITIONAL GAP AT
DOOR = 2" APPROX
TRACK 25
TRACK 24
R=1551.2'
L=58.44'
1:1007
0.2177
L=26.0'
TRACK 23
TRACK 22
144+00
50'
0'
50'
100'
GRAPHIC SCALE
TRACK 21
CALTRAIN DOWNTOWN EXTENSION
650' RADIUS HSR TRACKS
AND PLATFORM EXTENSION STUDY
FIGURE 2 - TAPERED PLAFORM
MARCH 9, 2010


Max. Gap*
TRACK 26
3.7"
29.1 feet
TRACK 25
4.7"
56.5 feet
TRACK 24
6.7"
108.9 feet
TRACK 23
10.1"
82.5 feet
TRACK 22
TRACK 21
CALTRAIN DOWNTOWN EXTENSION
650' RADIUS HSR TRACKS
AND PLATFORM EXTENSION STUDY
16 March 2010
* Based on Shinkansen N700




CALTRAIN DOWNTOWN EXTENSION
650' RADIUS HSR TRACKS
AND PLATFORM EXTENSION STUDY
FIGURE 3 - 201 MISSION BUILDING
MARCH 9, 2010

Phase 1 Train Box

# Transit Analysis

**Information on Ridership**

As currently projected, the proposed HST program would have approximately 25,000 daily boardings at the Transit Center. Using the most-recent estimates of arrival and departure characteristics of the HST passengers (see the October 16, 2009 letter from Dominic Spaethling at CHSRA to Bradford Townsend at TJPA, referred to as "*2009 Letter*"), information obtained from CHSRA and other sources, the following weekday PM peak hour travel demand by mode was estimated.

The 2009 Business Plan estimated that HST weekday daily boardings at the Transit Center are expected to be 20,600 for inter-regional trips and 4,400 for local trips, and 12% of the inter-regional trips and 17% of local trips are expected to occur during the peak hour, with the strongest directional demand (20% more riders) occurring for outbound local trips during the PM peak hour. These factors are summarized in Table 1 and used to calculate the boardings expected during the PM peak hour at the Transit Center.

**Table 1**
**Summary of PM Peak Hour Boarding Calculations**

| Origin/Destination Market | Daily Boardings | Peak Hour as Percent of Daily | PM Peak Southbound Peaking Factor | PM Peak Boardings |
|---|---|---|---|---|
| Inter-Regional | 20,600 | 12% | 1.0 | 2,472 |
| Local | 4,400 | 17% | 1.2 | 898 |
| **Total** | **25,000** | | | **3,370** |

Based on data presented in the *2009 Letter*, the PM peak hour alightings are expected to be approximately 53% of the PM peak hour boardings, which correspond to 1,780 PM peak hour alightings.

The *2009 Letter* also included the latest estimates of mode of travel (e.g., by private vehicles, transit, walk, etc.) for HST passengers at the Transit Center. However, this data does not fully account for the unique travel characteristics in downtown San Francisco and the currently-proposed program at the Transit Center (for instance, no rental car facilities or dedicated parking facilities are proposed). As such, modifications to the values were applied. The resulting estimates of the modal distribution are presented in Table 2.

**Table 2**
**Summary of HST Passenger Mode of Travel**

| Source | Pick-up or Drop-off | Drive and Parked Own Vehicle | Rental Car | Taxi | Transit or Shuttle | Bike and Walk | Total |
|---|---|---|---|---|---|---|---|
| Original CHSRA Estimates | 13% | 14% | 7% | 9% | 27% | 30% | 100% |
| Revised Estimates | 13% | 12% | 0% | 10% | 33% | 32% | 100% |

For these revised estimates, the following modifications to the original CHSRA estimates were made:

- The percentage of passengers who would drive and park own vehicle was reduced to account for the limited off-street parking available within the vicinity of the Transit Center. With the elimination of the public and private facilities on the site with the development of the Transbay Program, parking occupancy in the study area is projected to be close to 100% of capacity. This lack of availability, which would lead to a corresponding increase in parking costs, would force HST riders to divert to other modes, such as transit or walk/bike.
- Since no rental car facilities are proposed in the Transit Center and there are no nearby rental car offices, all HST passengers wishing to rent a vehicle would need to either take a taxi or transit (or a rental car shuttle) to and from the Transit Center.

For the HST passengers who would take transit or a shuttle, an assignment to the various transit operators was made based on the current and future transit ridership and capacity data in downtown San Francisco and taking into consideration of the likely origin and destination HST passengers in San Francisco and the region. The following presents the estimated distribution of transit riders (rounded to the nearest 5%):

- Muni buses that serve the Transit Center = 30%
- Muni Metro light rail (via the Market Street subway) or buses that do not serve the Transit Center = 30%
- BART to East Bay = 10%
- AC Transit = 10%
- Golden Gate Transit = 5%
- Other shuttles and transit = 20%

Table 3 presents the overall assignment of boarding and alighting HSR passengers at the Transit Center, in terms of primary mode of travel to and from the terminal.

Table 4 presents the actual mode of ingress and egress for HSR passengers at the Transit Center (i.e., vehicle, transit, walk and bike). Since all parking spaces would be located outside the terminal and some transit providers would not directly serve the Transit Center (such as BART, some Muni bus lines, and all Muni Metro light rail lines), these trips were assigned as walk trips to and from the Transit Center. Similarly, all drop-off and pick-up activities and taxis were assigned as vehicle trips to and from the Transit Center.

**Table 3**
**Summary of PM Peak Boardings and Alightings by Mode**

| | Pick-up or Drop-off | Drive & Parked Vehicle | Taxi | Transit or Shuttle | Walk or Bike | Total |
|---|---|---|---|---|---|---|
| Overall Mode Splits | 13% | 12% | 10% | 33% | 32% | **100%** |

| | Pick-up or Drop-off | Drive & Parked Vehicle | Taxi | Muni | AC Transit | BART | GGT | Shuttles & Other | Walk | Bike | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Boardings | 438 | 404 | 337 | 337 | 101 | 101 | 34 | 202 | 404 | 34 | **3,370** |
| Alightings | 231 | 214 | 178 | 178 | 53 | 53 | 18 | 107 | 214 | 18 | **1,780** |
| **Total** | **670** | **618** | **515** | **515** | **154** | **154** | **52** | **309** | **618** | **52** | **5,150** |

**Table 4**
**PM Peak HST Passengers by Mode of Access at Transit Center**

| | Vehicle (Taxi and Pick-up/Drop-off) | Transit (AC Transit, GGT, Muni and Shuttle at Terminal) | Walk (Primary mode, Walk to Transit, Walk to Parking) | Bike | Total |
|---|---|---|---|---|---|
| Mode of Access | 23% | 33% | 43% | 1% | **100%** |
| Boardings | 775 | 1,112 | 1,449 | 34 | 3,370 |
| Alightings | 409 | 587 | 766 | 18 | 1,780 |
| **Total** | **1,184** | **1,699** | **2,215** | **52** | **5,150** |

# Vehicular Traffic Analysis

### Analysis Methodology

The operation of intersections can be analyzed using the level of service (LOS) methodology, a qualitative description of the performance of an intersection based on the average delay per vehicle. Intersection LOS ranges from LOS A, which indicates free flow or excellent conditions with short delays, to LOS F, which indicates congested or overloaded conditions with extremely long delays. LOS definitions for signalized intersections are described in **Table 1**. In San Francisco, LOS A through LOS D are considered excellent to satisfactory service levels, and LOS E and LOS F represent unacceptable service levels.

**Table 1: Intersection Level of Service Definitions**

| LOS | Description | Total Delay (seconds/vehicle) |
|---|---|---|
| A | Little or no delay | $\leq$ 10.0 |
| B | Short traffic delay | > 10.0 and $\leq$ 20.0 |
| C | Average traffic delay | > 20.0 and $\leq$ 35.0 |
| D | Long traffic delay | > 35.0 and $\leq$ 55.0 |
| E | Very long traffic delay | > 55.0 and $\leq$ 80.0 |
| F | Extreme traffic delay | > 80.0 |

Source: *Highway Capacity Manual*, Transportation Research Board, 2000.

It should be noted that delay for intersections operating at LOS F is typically reported as "greater than 80.0 seconds," as 80.0 seconds is generally considered the limit of the meaningful range for the analysis methodology. However, since a substantial percentage of the analysis locations are projected to operate at LOS F under future-year scenarios, the actual seconds of delays are reported in order to facilitate comparison between scenarios. As such, changes in delays should only be considered at an order-of-magnitude basis.

The 27 study intersections were evaluated using the *2000 Highway Capacity Manual* (HCM) methodology[1]. For signalized intersections, this methodology determines the capacity of each lane group approaching the intersection. The LOS is then based on average delay (in seconds per vehicle) for the various movements within the intersection. A combined weighted average delay and LOS are presented for the intersection. As required by the City and County of San Francisco, LOS is calculated using Dowling Associates' Traffix 8.0 software package.

(1) As part of the HCM methodology, adjustments are typically made to the capacity of each intersection to account for various factors that reduce the ability of the streets to accommodate vehicles (such as the downtown nature of the area, number of pedestrians, bus stops, vehicle types, lane widths, grades, on-street parking and queues).

**2030 plus Project and Public Realm Plan Conditions**

2030 plus Project and Public Realm Plan Conditions assume the rezoning of the Transit Center District soft sites and the roadway improvements proposed under the Public Realm Plan. Those proposed roadway improvements include the following elements:

- Provision of transit-only lanes on the following corridors:
    - Fremont Street between the Transbay Transit Center bus plaza and Mission Street; and,
    - Beale Street between Market Street and the Transbay Transit Center bus plaza;
- Strict enforcement of transit-only lanes on Mission street between Main Street and Third Street (although these lanes are currently present, they are not fully enforced and are used by regular traffic);
- Restriction of private vehicle access on Mission Street between Fremont Street and First Street;
- Establishment of two-way traffic and traffic lane reduction on the following currently one-way facilities:
    - Howard Street between Fremont Street and Second Street;
    - Folsom Street between Main Street and Second Street;
    - Spear Street between Market Street and Harrison Street; and,
    - Main Street between Market Street and Folsom Street
- Provision of median islands and center turn-lanes, resulting in a one lane reduction in each direction, on Second Street between Market Street and Folsom Street;
- Provision of extra-wide sidewalks, resulting in a one lane reduction, on the following corridors:
    - West side of Main Street between Market Street and Harrison Street;
    - West side of Spear Street between Market Street and Harrison Street;
    - East side of Beale Street between Market Street and Harrison Street; and,
    - West side of Fremont Street between Market Street and Mission Street.
- Provision of improved and wider sidewalks along both sides of major corridors within the project area; and,
- Provision of intersection bulb-outs at most locations within the project area.

## Project Contributions- 2030 plus Project

| | Intersection | Mvmt | Project Contrib. to Movement | Mvmt Share of Intersection |
|---|---|---|---|---|
| 1 | First/Market | SBT | **6.8%** | **45.3%** |
| | | EBR | 2.7% | 10.3% |
| 2 | Fremont/Market | NBT | 2.8% | 53.6% |
| | | NBR | 1.2% | 12.0% |
| 4 | First/Mission | SBT | 0.9% | 67.5% |
| | | SBR | **16.0%** | **19.8%** |
| | | WBT | 100.0% | 0.9% |
| 5 | Fremont/Mission | NBL | 100.0% | 0.9% |
| | | NBT | 2.7% | 71.1% |
| | | NBR | 4.6% | 23.4% |
| 6 | Beale/Mission | SBT | 0.2% | 62.6% |
| | | EBT | **8.0%** | **11.6%** |
| 7 | Main/Mission | EBT | **7.5%** | **16.8%** |
| 8 | Second/Howard | WBL | **9.3%** | **12.0%** |
| | | WBT | 4.7% | 46.0% |
| | | WBR | 3.0% | 3.0% |
| 9 | First/ Howard | SBT | 3.1% | 22.7% |
| | | SBR | **14.8%** | **24.7%** |
| 10 | Fremont/Howard | NBT | **18.1%** | **33.1%** |
| | | WBR | 7.6% | 3.6% |
| 11 | Beale/Howard | WBT | 1.5% | 18.3% |
| 12 | Main/Howard | NBL | 3.3% | 3.6% |
| | | WBT | 1.5% | 18.2% |
| 14 | Second/Folsom | WBR | 33.7% | 4.9% |
| | | SBL | 3.5% | 6.1% |
| | | SBT | **5.1%** | **25.5%** |
| | | EBT | **8.1%** | **33.1%** |
| 15 | First/Folsom | SBL | 1.7% | 9.9% |
| | | SBT | 3.4% | 30.7% |
| | | EBT | 24.5% | 25.4% |
| 16 | Fremont/Folsom | NBT | 8.6% | 1.6% |
| | | EBL | **46.4%** | **18.1%** |
| | | EBT | 0.6% | 23.1% |
| 17 | Beale/Folsom | EBT | 0.4% | 33.0% |
| 18 | Main/Folsom | NBT | 0.6% | 7.0% |
| | | EBT | 0.1% | 39.4% |
| | | EBR | 0.3% | 13.8% |
| 19 | Spear/Folsom | EBT | 0.1% | 34.3% |
| 20 | The Embarcadero/Folsom | EBR | 0.3% | 7.8% |
| 21 | Second/Harrison | NBT | **13.2%** | **13.2%** |
| | | SBT | 3.7% | 14.6% |
| | | SBR | **6.3%** | **13.0%** |
| | | EBT | 0.4% | 6.0% |
| 22 | First/Harrison | SBL | 8.7% | 0.7% |
| | | SBT | 2.0% | 43.4% |
| | | EBT | 1.5% | 1.9% |
| 23 | Fremont/Harrison | EBL | 37.5% | 0.5% |
| 24 | Main/Harrison | NBT | 0.3% | 15.8% |
| 26 | Second/Bryant | NBT | 4.7% | 21.6% |
| | | SBT | 3.3% | 21.3% |
| | | EBT | 4.6% | 26.1% |

Source: AECOM, 2010.

Notes:

Movements that are impacted by the Project are shown in **bold**.

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #1 First / Market / Battery / Bush

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.131 |
| Loss Time (sec): | 13 | Average Delay (sec/veh): | 95.8 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | First / Battery / Bush | | | | | | Market | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 18 | 18 | 18 | 0 | 29 | 29 | 29 | 29 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 113 | 1075 | 262 | 0 | 403 | 254 | 3 | 349 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 113 | 1075 | 262 | 0 | 403 | 254 | 3 | 349 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 115 | 1097 | 267 | 0 | 411 | 259 | 3 | 356 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 115 | 1097 | 267 | 0 | 411 | 259 | 3 | 356 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 115 | 1097 | 267 | 0 | 411 | 259 | 3 | 356 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 0.64 | 0.71 | 0.56 | 1.00 | 0.73 | 0.28 | 0.73 | 0.73 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 1.00 | 2.00 | 2.00 | 0.00 | 1.00 | 1.00 | 0.02 | 1.98 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 1211 | 2706 | 2131 | 0 | 1384 | 540 | 24 | 2768 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.10 | 0.41 | 0.13 | 0.00 | 0.30 | 0.48 | 0.13 | 0.13 | 0.00 |
| Crit Moves: | | | | | **** | | | | **** | | | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.30 | 0.30 | 0.30 | 0.00 | 0.48 | 0.48 | 0.48 | 0.48 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.32 | 1.35 | 0.42 | 0.00 | 0.61 | 0.99 | 0.27 | 0.27 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 16.2 | 21.0 | 16.8 | 0.0 | 11.4 | 15.4 | 9.2 | 9.2 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 2.3 | 166 | 2.0 | 0.0 | 4.2 | 54.1 | 0.5 | 0.5 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 18.5 | 187 | 18.8 | 0.0 | 15.6 | 69.6 | 9.7 | 9.7 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 18.5 | 187 | 18.8 | 0.0 | 15.6 | 69.6 | 9.7 | 9.7 | 0.0 |
| LOS by Move: | A | A | A | B | F | B | A | B | E | A | A | ,A |
| HCM2kAvgQ: | 0 | 0 | 0 | 2 | 32 | 3 | 0 | 7 | 10 | 2 | 2 | 0 |





Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #2 Fremont / Market / Front

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.261 |
| Loss Time (sec): | 11 | Average Delay (sec/veh): | 250.7 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Fremont / Front | | | | | | Market | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 27 | 27 | 27 | 0 | 0 | 0 | 22 | 22 | 0 | 0 | 22 | 22 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 63 | 1410 | 321 | 0 | 0 | 0 | 7 | 540 | 0 | 0 | 304 | 15 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 63 | 1410 | 321 | 0 | 0 | 0 | 7 | 540 | 0 | 0 | 304 | 15 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 64 | 1439 | 328 | 0 | 0 | 0 | 7 | 551 | 0 | 0 | 310 | 15 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 64 | 1439 | 328 | 0 | 0 | 0 | 7 | 551 | 0 | 0 | 310 | 15 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 64 | 1439 | 328 | 0 | 0 | 0 | 7 | 551 | 0 | 0 | 310 | 15 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.75 | 0.60 | 0.60 | 1.00 | 1.00 | 1.00 | 0.77 | 0.62 | 1.00 | 1.00 | 0.62 | 0.62 |
| Lanes: | 0.06 | 1.58 | 0.36 | 0.00 | 0.00 | 0.00 | 0.02 | 1.98 | 0.00 | 0.00 | 1.91 | 0.09 |
| Final Sat.: | 81 | 1815 | 413 | 0 | 0 | 0 | 30 | 2327 | 0 | 0 | 2248 | 111 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.79 | 0.79 | 0.79 | 0.00 | 0.00 | 0.00 | 0.24 | 0.24 | 0.00 | 0.00 | 0.14 | 0.14 |
| Crit Moves: | **** | | | | | | | **** | | | | |
| Green/Cycle: | 0.45 | 0.45 | 0.45 | 0.00 | 0.00 | 0.00 | 0.37 | 0.37 | 0.00 | 0.00 | 0.37 | 0.37 |
| Volume/Cap: | 1.76 | 1.76 | 1.76 | 0.00 | 0.00 | 0.00 | 0.65 | 0.65 | 0.00 | 0.00 | 0.38 | 0.38 |
| Uniform Del: | 16.5 | 16.5 | 16.5 | 0.0 | 0.0 | 0.0 | 15.8 | 15.8 | 0.0 | 0.0 | 14.0 | 14.0 |
| IncremntDel: | 346.6 | 347 | 346.6 | 0.0 | 0.0 | 0.0 | 3.7 | 3.7 | 0.0 | 0.0 | 1.3 | 1.3 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Delay/Veh: | 363.1 | 363 | 363.1 | 0.0 | 0.0 | 0.0 | 19.5 | 19.5 | 0.0 | 0.0 | 15.2 | 15.2 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 363.1 | 363 | 363.1 | 0.0 | 0.0 | 0.0 | 19.5 | 19.5 | 0.0 | 0.0 | 15.2 | 15.2 |
| LOS by Move: | F | F | F | A | A | A | B | B | A | A | B | B |
| HCM2kAvgQ: | 87 | 70 | 70 | 0 | 0 | 0 | 6 | 5 | 0 | 0 | 3 | 3 |

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #3 Second / Mission

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.885 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 27.6 |
| Optimal Cycle: | 74 | Level Of Service: | C |

| Street Name: | Second | | | | | | Mission | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 21 | 21 | 21 | 21 | 21 | 21 | 31 | 31 | 31 | 31 | 31 | 31 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 1 | 0 1 | 0 1 | 1 | 0 1 | 0 1 | 0 | 1 0 | 1 0 | 0 | 1 0 | 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 173 | 308 | 128 | 21 | 293 | 60 | 1 | 125 | 540 | 4 | 371 | 125 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 173 | 308 | 128 | 21 | 293 | 60 | 1 | 125 | 540 | 4 | 371 | 125 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 177 | 314 | 131 | 21 | 299 | 61 | 1 | 128 | 551 | 4 | 379 | 128 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 177 | 314 | 131 | 21 | 299 | 61 | 1 | 128 | 551 | 4 | 379 | 128 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 177 | 314 | 131 | 21 | 299 | 61 | 1 | 128 | 551 | 4 | 379 | 128 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.29 | 0.62 | 0.52 | 0.22 | 0.49 | 0.41 | 0.66 | 0.43 | 0.66 | 0.72 | 0.48 | 0.72 |
| Lanes: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.01 | 0.99 | 1.00 | 0.01 | 1.63 | 0.36 |
| Final Sat.: | 550 | 1173 | 997 | 416 | 922 | 783 | 7 | 817 | 1245 | 16 | 1475 | 497 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.32 | 0.27 | 0.13 | 0.05 | 0.32 | 0.08 | 0.16 | 0.16 | 0.44 | 0.26 | 0.26 | 0.26 |
| Crit Moves: | | | | | **** | | | | **** | | | |
| Green/Cycle: | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 |
| Volume/Cap: | 0.92 | 0.77 | 0.37 | 0.15 | 0.93 | 0.22 | 0.30 | 0.30 | 0.86 | 0.50 | 0.50 | 0.50 |
| Uniform Del: | 18.7 | 17.3 | 14.6 | 13.4 | 18.8 | 13.7 | 8.3 | 8.3 | 12.6 | 9.4 | 9.4 | 9.4 |
| IncremntDel: | 48.1 | 12.4 | 3.1 | 2.1 | 34.5 | 1.9 | 0.3 | 0.3 | 11.5 | 1.7 | 1.7 | 1.7 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 66.8 | 29.7 | 17.6 | 15.5 | 53.3 | 15.6 | 8.7 | 8.7 | 24.1 | 11.1 | 11.1 | 11.1 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 66.8 | 29.7 | 17.6 | 15.5 | 53.3 | 15.6 | 8.7 | 8.7 | 24.1 | 11.1 | 11.1 | 11.1 |
| LOS by Move: | E | C | B | B | D | B | A | A | C | B | B | B |
| HCM2kAvgQ: | 5 | 2 | 1 | 1 | 10 | 1 | 2 | 1 | 9 | 5 | 4 | 5 |





Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #4 First / Mission

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.468 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 297.3 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | First | | | | | | Mission | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 23 | 23 | 23 | 0 | 29 | 29 | 29 | 29 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 0 | 0 0 | 0 | 0 2 | 1 0 | 0 | 0 0 | 0 1 | 0 | 0 1 | 0 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 0 | 1536 | 382 | 0 | 0 | 269 | 0 | 0 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 0 | 1536 | 382 | 0 | 0 | 269 | 0 | 0 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 0 | 1567 | 390 | 0 | 0 | 274 | 0 | 0 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 0 | 1567 | 390 | 0 | 0 | 274 | 0 | 0 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 0 | 1567 | 390 | 0 | 0 | 274 | 0 | 0 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 0.70 | 0.54 | 0.54 | 1.00 | 0.66 | 0.23 | 1.00 | 0.66 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 0.00 | 2.40 | 0.60 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 0 | 2488 | 619 | 0 | 0 | 428 | 0 | 0 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.00 | 0.63 | 0.63 | 0.00 | 0.00 | 0.64 | 0.00 | 0.00 | 0.00 |
| Crit Moves: | | | | | | **** | | | **** | | | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.00 | 0.38 | 0.38 | 0.00 | 0.00 | 0.48 | 0.00 | 0.00 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.00 | 1.64 | 1.64 | 0.00 | 0.00 | 1.33 | 0.00 | 0.00 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 0.0 | 18.5 | 18.5 | 0.0 | 0.0 | 15.5 | 0.0 | 0.0 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 0.0 | 293 | 293.4 | 0.0 | 0.0 | 177.2 | 0.0 | 0.0 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 312 | 311.9 | 0.0 | 0.0 | 192.7 | 0.0 | 0.0 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 312 | 311.9 | 0.0 | 0.0 | 192.7 | 0.0 | 0.0 | 0.0 |
| LOS by Move: | A | A | A | A | F | F | A | A | F | A | A | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 0 | 49 | 49 | 0 | 0 | 16 | 0 | 0 | 0 |

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #5 Fremont / Mission

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.478 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 209.6 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Fremont | | | | | | Mission | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 33 | 33 | 33 | 0 | 0 | 0 | 19 | 19 | 0 | 0 | 19 | 19 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 1 | 1 0 | 1 | 0 | 0 0 | 0 | 0 | 0 0 | 0 | 0 | 0 1 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 1536 | 495 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 1536 | 495 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 1567 | 505 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 105 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 1567 | 505 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 105 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 1567 | 505 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 105 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.50 | 0.63 | 0.22 | 1.00 | 1.00 | 1.00 | 1.00 | 0.66 | 1.00 | 1.00 | 0.66 | 0.74 |
| Lanes: | 0.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Final Sat.: | 0 | 2388 | 419 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1408 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.66 | 1.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 |
| Crit Moves: | | | **** | | | | | | | | | **** |
| Green/Cycle: | 0.55 | 0.55 | 0.55 | 0.00 | 0.00 | 0.00 | 0.32 | 0.32 | 0.00 | 0.00 | 0.32 | 0.32 |
| Volume/Cap: | 0.00 | 1.19 | 2.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.23 |
| Uniform Del: | 0.0 | 13.5 | 13.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.0 |
| IncremntDel: | 0.0 | 94.8 | 550.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Delay/Veh: | 0.0 | 108 | 564.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16.2 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 108 | 564.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16.2 |
| LOS by Move: | A | F | F | A | A | A | A | A | A | A | A | B |
| HCM2kAvgQ: | 0 | 35 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |





Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #6 Beale / Mission

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.987 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 178.3 |
| Optimal Cycle: | 119 | Level Of Service: | F |

| Street Name: | Beale | | | | | | Mission | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 21 | 21 | 21 | 0 | 31 | 31 | 31 | 31 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 0 0 | 0 | 1 | 1 0 | 1 | 0 | 1 | 1 | 0 | 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 60 | 1610 | 19 | 0 | 275 | 258 | 281 | 48 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 60 | 1610 | 19 | 0 | 275 | 258 | 281 | 48 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 61 | 1643 | 19 | 0 | 281 | 263 | 287 | 49 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 61 | 1643 | 19 | 0 | 281 | 263 | 287 | 49 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 61 | 1643 | 19 | 0 | 281 | 263 | 287 | 49 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 0.83 | 0.83 | 0.75 | 1.00 | 0.57 | 0.73 | 0.48 | 0.57 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 0.07 | 1.93 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Final Sat.: | 0 | 0 | 0 | 114 | 3054 | 1424 | 0 | 1074 | 1384 | 903 | 1074 | 1900 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.54 | 0.54 | 0.01 | 0.00 | 0.26 | 0.19 | 0.32 | 0.05 | 0.00 |
| Crit Moves: | | | | | **** | | | | | **** | | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.35 | 0.35 | 0.35 | 0.00 | 0.52 | 0.52 | 0.52 | 0.52 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 1.54 | 1.54 | 0.04 | 0.00 | 0.51 | 0.37 | 0.61 | 0.09 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 19.5 | 19.5 | 12.8 | 0.0 | 9.5 | 8.7 | 10.3 | 7.3 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 246.1 | 246 | 0.1 | 0.0 | 3.3 | 1.5 | 5.9 | 0.3 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 265.6 | 266 | 13.0 | 0.0 | 12.8 | 10.1 | 16.2 | 7.7 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 265.6 | 266 | 13.0 | 0.0 | 12.8 | 10.1 | 16.2 | 7.7 | 0.0 |
| LOS by Move: | A | A | A | F | F | B | A | B | B | B | A | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 57 | 57 | 0 | 0 | 4 | 3 | 5 | 1 | 0 |

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #7 Main / Mission

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.879 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 104.2 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Main | | | | | | Mission | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permit+Prot | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 21 | 21 | 21 | 0 | 0 | 0 | 8 | 31 | 0 | 0 | 19 | 19 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! 0 | 0 | 1 | 0 0 | 1 | 0 1 | 1 0 | 0 | 1 | 0 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 180 | 427 | 173 | 110 | 343 | 0 | 48 | 296 | 0 | 55 | 173 | 79 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 180 | 427 | 173 | 110 | 343 | 0 | 48 | 296 | 0 | 55 | 173 | 79 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 184 | 436 | 177 | 112 | 350 | 0 | 49 | 302 | 0 | 56 | 177 | 81 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 184 | 436 | 177 | 112 | 350 | 0 | 49 | 302 | 0 | 56 | 177 | 81 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 184 | 436 | 177 | 112 | 350 | 0 | 49 | 302 | 0 | 56 | 177 | 81 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.81 | 0.81 | 0.81 | 0.87 | 0.87 | 1.00 | 0.47 | 0.81 | 0.95 | 0.77 | 0.77 | 0.77 |
| Lanes: | 0.23 | 0.55 | 0.22 | 0.24 | 0.76 | 0.00 | 1.00 | 2.00 | 0.00 | 0.36 | 1.13 | 0.51 |
| Final Sat.: | 356 | 945 | 342 | 402 | 1254 | 0 | 892 | 3093 | 0 | 522 | 1643 | 750 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.52 | 0.52 | 0.52 | 0.28 | 0.28 | 0.00 | 0.05 | 0.10 | 0.00 | 0.11 | 0.11 | 0.11 |
| Crit Moves: | | | **** | **** | | | **** | | | | **** | |
| Green/Cycle: | 0.35 | 0.35 | 0.35 | 0.00 | 0.00 | 0.00 | 0.51 | 0.51 | 0.00 | 0.00 | 0.31 | 0.31 |
| Volume/Cap: | 1.47 | 1.47 | 1.47 | xxxx | xxxx | 0.00 | 0.09 | 0.19 | 0.00 | xxxx | 0.35 | 0.35 |
| Uniform Del: | 19.5 | 19.5 | 19.5 | 0.0 | 0.0 | 0.0 | 9.4 | 8.0 | 0.0 | 0.0 | 16.0 | 16.0 |
| IncremntDel: | 223.0 | 223 | 223.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 1.1 | 1.1 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Delay/Veh: | 242.5 | 242 | 242.5 | 0.0 | 0.0 | 0.0 | 9.8 | 8.3 | 0.0 | 0.0 | 17.1 | 17.1 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 242.5 | 242 | 242.5 | 0.0 | 0.0 | 0.0 | 9.8 | 8.3 | 0.0 | 0.0 | 17.1 | 17.1 |
| LOS by Move: | F | F | F | A | A | A | A | A | A | A | B | B |
| HCM2kAvgQ: | 45 | 45 | 45 | 0 | 0 | 0 | 1 | 2 | 0 | 3 | 2 | 2 |





Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #8 Second / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 5.115 |
| Loss Time (sec): | 7 | Average Delay (sec/veh): | 855.3 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Second | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Split Phase | | | Split Phase | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 21 | 21 | 0 | 0 | 21 | 21 | 0 | 0 | 0 | 32 | 32 | 32 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 1 | 0 | 0 1 | 0 | 1 | 0 0 1 | 0 | 0 | 0 0 | 0 | 1 | 0 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 441 | 405 | 387 | 0 | 446 | 527 | 0 | 0 | 0 | 617 | 2474 | 162 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 441 | 405 | 387 | 0 | 446 | 527 | 0 | 0 | 0 | 617 | 2474 | 162 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 450 | 413 | 395 | 0 | 455 | 538 | 0 | 0 | 0 | 630 | 2524 | 165 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 450 | 413 | 395 | 0 | 455 | 538 | 0 | 0 | 0 | 630 | 2524 | 165 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 450 | 413 | 395 | 0 | 455 | 538 | 0 | 0 | 0 | 630 | 2524 | 165 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.08 | 0.42 | 0.82 | 0.75 | 0.44 | 0.44 | 1.00 | 1.00 | 1.00 | 0.60 | 0.60 | 0.60 |
| Lanes: | 1.00 | 0.67 | 0.33 | 1.00 | 0.46 | 0.54 | 0.00 | 0.00 | 0.00 | 0.38 | 1.52 | 0.10 |
| Final Sat.: | 146 | 533 | 509 | 1425 | 379 | 448 | 0 | 0 | 0 | 435 | 1746 | 114 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 3.07 | 0.78 | 0.78 | 0.00 | 1.20 | 1.20 | 0.00 | 0.00 | 0.00 | 1.45 | 1.45 | 1.45 |
| Crit Moves: | **** | | | | | | | | | **** | | |
| Green/Cycle: | 0.35 | 0.35 | 0.35 | 0.00 | 0.35 | 0.35 | 0.00 | 0.00 | 0.00 | 0.53 | 0.53 | 0.53 |
| Volume/Cap: | 3.75 | 2.22 | 2.22 | 0.00 | 3.43 | 3.43 | 0.00 | 0.00 | 0.00 | 2.71 | 2.71 | 2.71 |
| Uniform Del: | 19.5 | 19.5 | 19.5 | 0.0 | 19.5 | 19.5 | 0.0 | 0.0 | 0.0 | 14.0 | 14.0 | 14.0 |
| IncremntDel: | 1258 | 556 | 556.3 | 0.0 | 1103 | 1103 | 0.0 | 0.0 | 0.0 | 772.3 | 772 | 772.3 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 1277 | 576 | 575.8 | 0.0 | 1122 | 1122 | 0.0 | 0.0 | 0.0 | 786.3 | 786 | 786.3 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 1277 | 576 | 575.8 | 0.0 | 1122 | 1122 | 0.0 | 0.0 | 0.0 | 786.3 | 786 | 786.3 |
| LOS by Move: | F | F | F | A | F | F | A | A | A | F | F | F |
| HCM2kAvgQ: | 50 | 54 | 105 | 0 | 106 | 106 | 0 | 0 | 0 | 169 | 169 | 169 |

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #9 First / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 2.297 |
| Loss Time (sec): | 11 | Average Delay (sec/veh): | 420.4 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | First | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 0 | 25 | 25 | 0 | 0 | 0 | 24 | 24 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 0 | 0 | 1 | 0 2 1 0 | 0 | 0 | 0 1 0 | 0 | 0 | 2 0 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 76 | 1144 | 1093 | 0 | 710 | 80 | 0 | 1869 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 76 | 1144 | 1093 | 0 | 710 | 80 | 0 | 1869 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 78 | 1167 | 1115 | 0 | 724 | 82 | 0 | 1907 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 78 | 1167 | 1115 | 0 | 724 | 82 | 0 | 1907 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 78 | 1167 | 1115 | 0 | 724 | 82 | 0 | 1907 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 0.75 | 0.45 | 0.52 | 1.00 | 0.89 | 0.89 | 0.65 | 0.67 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 1.00 | 2.00 | 1.00 | 0.00 | 0.90 | 0.10 | 0.00 | 2.00 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 1424 | 1696 | 990 | 0 | 1515 | 171 | 0 | 2547 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.05 | 0.69 | 1.13 | 0.00 | 0.48 | 0.48 | 0.00 | 0.75 | 0.00 |
| Crit Moves: | | | | | | **** | | | | | **** | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.42 | 0.42 | 0.42 | 0.00 | 0.40 | 0.40 | 0.00 | 0.40 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.13 | 1.65 | 2.70 | 0.00 | 1.20 | 1.20 | 0.00 | 1.87 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 10.8 | 17.5 | 17.5 | 0.0 | 18.0 | 18.0 | 0.0 | 18.0 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 0.5 | 296 | 770.6 | 0.0 | 102 | 102.0 | 0.0 | 396 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 11.3 | 314 | 788.1 | 0.0 | 120 | 120.0 | 0.0 | 414 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 11.3 | 314 | 788.1 | 0.0 | 120 | 120.0 | 0.0 | 414 | 0.0 |
| LOS by Move: | A | A | A | B | F | F | A | F | F | A | F | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 1 | 45 | 119 | 0 | 35 | 35 | 0 | 75 | 0 |





Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #10 Fremont / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 4.359 |
| Loss Time (sec): | 12 | Average Delay (sec/veh): | 453.6 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Fremont | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 21 | 21 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 27 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 1 | 0 2 | 1 0 | 0 | 0 | 0 0 0 | 0 | 1 | 0 0 0 | 0 | 0 | 1 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 580 | 1312 | 339 | 0 | 0 | 0 | 407 | 221 | 0 | 0 | 1512 | 159 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 580 | 1312 | 339 | 0 | 0 | 0 | 407 | 221 | 0 | 0 | 1512 | 159 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 592 | 1339 | 346 | 0 | 0 | 0 | 415 | 226 | 0 | 0 | 1543 | 162 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 592 | 1339 | 346 | 0 | 0 | 0 | 415 | 226 | 0 | 0 | 1543 | 162 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 592 | 1339 | 346 | 0 | 0 | 0 | 415 | 226 | 0 | 0 | 1543 | 162 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.75 | 0.78 | 0.78 | 1.00 | 1.00 | 1.00 | 0.11 | 0.11 | 1.00 | 1.00 | 0.82 | 0.82 |
| Lanes: | 1.00 | 2.38 | 0.62 | 0.00 | 0.00 | 0.00 | 0.65 | 0.35 | 0.00 | 0.00 | 1.81 | 0.19 |
| Final Sat.: | 1424 | 3523 | 910 | 0 | 0 | 0 | 135 | 73 | 0 | 0 | 2829 | 298 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.42 | 0.38 | 0.38 | 0.00 | 0.00 | 0.00 | 3.07 | 3.07 | 0.00 | 0.00 | 0.55 | 0.55 |
| Crit Moves: | **** | | | | | | | **** | | | | |
| Green/Cycle: | 0.35 | 0.35 | 0.35 | 0.00 | 0.00 | 0.00 | 0.45 | 0.45 | 0.00 | 0.00 | 0.45 | 0.45 |
| Volume/Cap: | 1.19 | 1.09 | 1.09 | 0.00 | 0.00 | 0.00 | 6.83 | 6.83 | 0.00 | 0.00 | 1.21 | 1.21 |
| Uniform Del: | 19.5 | 19.5 | 19.5 | 0.0 | 0.0 | 0.0 | 16.5 | 16.5 | 0.0 | 0.0 | 16.5 | 16.5 |
| IncremntDel: | 102.9 | 50.0 | 50.0 | 0.0 | 0.0 | 0.0 | 2644 | 2644 | 0.0 | 0.0 | 102 | 102.1 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Delay/Veh: | 122.4 | 69.5 | 69.5 | 0.0 | 0.0 | 0.0 | 2660 | 2660 | 0.0 | 0.0 | 119 | 118.6 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 122.4 | 69.5 | 69.5 | 0.0 | 0.0 | 0.0 | 2660 | 2660 | 0.0 | 0.0 | 119 | 118.6 |
| LOS by Move: | F | E | E | A | A | A | F | F | A | A | F | F |
| HCM2kAvgQ: | 26 | 23 | 23 | 0 | 0 | 0 | 80 | 80 | 0 | 0 | 39 | 39 |

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #11 Beale / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.766 |
| Loss Time (sec): | 10 | Average Delay (sec/veh): | 221.6 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Beale | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 31 | 31 | 31 | 0 | 19 | 19 | 19 | 19 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 0 0 | 1 | 0 1 | 1 0 | 0 | 0 0 | 1 0 | 0 | 1 1 | 0 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 158 | 994 | 894 | 0 | 590 | 55 | 0 | 594 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 158 | 994 | 894 | 0 | 590 | 55 | 0 | 594 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 161 | 1014 | 912 | 0 | 602 | 56 | 0 | 606 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 161 | 1014 | 912 | 0 | 602 | 56 | 0 | 606 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 161 | 1014 | 912 | 0 | 602 | 56 | 0 | 606 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 1.25 | 0.78 | 0.44 | 1.00 | 0.89 | 0.89 | 0.95 | 0.67 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.91 | 0.09 | 0.00 | 2.00 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 2379 | 1479 | 843 | 0 | 1547 | 144 | 0 | 2537 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.07 | 0.69 | 1.08 | 0.00 | 0.39 | 0.39 | 0.00 | 0.24 | 0.00 |
| Crit Moves: | | | | | | **** | | **** | | | | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.52 | 0.52 | 0.52 | 0.00 | 0.32 | 0.32 | 0.00 | 0.32 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.13 | 1.33 | 2.09 | 0.00 | 1.23 | 1.23 | 0.00 | 0.75 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 7.5 | 14.5 | 14.5 | 0.0 | 20.5 | 20.5 | 0.0 | 18.4 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 0.2 | 152 | 496.2 | 0.0 | 119 | 118.7 | 0.0 | 6.5 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 7.7 | 167 | 510.7 | 0.0 | 139 | 139.2 | 0.0 | 24.9 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 7.7 | 167 | 510.7 | 0.0 | 139 | 139.2 | 0.0 | 24.9 | 0.0 |
| LOS by Move: | A | A | A | A | F | F | A | F | F | A | C | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 2 | 54 | 71 | 0 | 31 | 31 | 0 | 7 | 0 |





Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #12 Main / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 3.353 |
| Loss Time (sec): | 7 | Average Delay (sec/veh): | 519.2 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Main | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 20 | 20 | 20 | 0 | 0 | 0 | 33 | 33 | 0 | 0 | 25 | 25 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! 0 | 0 | 0 1 | 0 0 | 0 | 1 0 | 0 0 | 0 | 1 0 | 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 87 | 779 | 17 | 0 | 409 | 0 | 205 | 381 | 0 | 87 | 446 | 70 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 87 | 779 | 17 | 0 | 409 | 0 | 205 | 381 | 0 | 87 | 446 | 70 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 89 | 795 | 17 | 0 | 417 | 0 | 209 | 389 | 0 | 89 | 455 | 71 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 89 | 795 | 17 | 0 | 417 | 0 | 209 | 389 | 0 | 89 | 455 | 71 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 89 | 795 | 17 | 0 | 417 | 0 | 209 | 389 | 0 | 89 | 455 | 71 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.81 | 0.81 | 0.81 | 1.00 | 0.90 | 1.00 | 0.13 | 0.13 | 0.25 | 0.26 | 0.26 | 0.26 |
| Lanes: | 0.10 | 0.88 | 0.02 | 0.00 | 1.00 | 0.00 | 0.35 | 0.65 | 0.00 | 0.29 | 1.48 | 0.23 |
| Final Sat.: | 153 | 1366 | 30 | 0 | 1710 | 0 | 88 | 163 | 0 | 140 | 718 | 113 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.58 | 0.58 | 0.58 | 0.00 | 0.24 | 0.00 | 2.38 | 2.38 | 0.00 | 0.63 | 0.63 | 0.63 |
| Crit Moves: | | **** | | | | | | **** | | | | |
| Green/Cycle: | 0.33 | 0.33 | 0.33 | 0.00 | 0.33 | 0.00 | 0.55 | 0.55 | 0.00 | 0.55 | 0.55 | 0.55 |
| Volume/Cap: | 1.75 | 1.75 | 1.75 | 0.00 | 0.73 | 0.00 | 4.33 | 4.33 | 0.00 | 1.15 | 1.15 | 1.15 |
| Uniform Del: | 20.0 | 20.0 | 20.0 | 0.0 | 17.6 | 0.0 | 13.5 | 13.5 | 0.0 | 13.5 | 13.5 | 13.5 |
| IncremntDel: | 343.8 | 344 | 343.8 | 0.0 | 8.1 | 0.0 | 1514 | 1514 | 0.0 | 88.5 | 88.5 | 88.5 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 363.8 | 364 | 363.8 | 0.0 | 25.7 | 0.0 | 1527 | 1527 | 0.0 | 102.0 | 102 | 102.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 363.8 | 364 | 363.8 | 0.0 | 25.7 | 0.0 | 1527 | 1527 | 0.0 | 102.0 | 102 | 102.0 |
| LOS by Move: | F | F | F | A | C | A | F | F | A | F | F | F |
| HCM2kAvgQ: | 65 | 65 | 65 | 0 | 9 | 0 | 69 | 69 | 0 | 15 | 15 | 15 |

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #13 Spear / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.033 |
| Loss Time (sec): | 7 | Average Delay (sec/veh): | 44.5 |
| Optimal Cycle: | 180 | Level Of Service: | D |

| Street Name: | Spear | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 25 | 25 | 25 | 0 | 28 | 28 | 28 | 28 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! 0 | 0 | 0 | 1! 0 | 0 | 1 | 0 1 | 0 | 1 | 0 1 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 42 | 254 | 83 | 97 | 238 | 200 | 39 | 328 | 87 | 124 | 400 | 71 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 42 | 254 | 83 | 97 | 238 | 200 | 39 | 328 | 87 | 124 | 400 | 71 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 43 | 259 | 85 | 99 | 243 | 204 | 40 | 335 | 89 | 127 | 408 | 72 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 43 | 259 | 85 | 99 | 243 | 204 | 40 | 335 | 89 | 127 | 408 | 72 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 43 | 259 | 85 | 99 | 243 | 204 | 40 | 335 | 89 | 127 | 408 | 72 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.81 | 0.81 | 0.81 | 0.65 | 0.65 | 0.65 | 0.72 | 0.36 | 0.36 | 0.32 | 0.32 | 0.64 |
| Lanes: | 0.11 | 0.67 | 0.22 | 0.18 | 0.45 | 0.37 | 0.09 | 1.51 | 0.40 | 0.44 | 1.43 | 0.13 |
| Final Sat.: | 170 | 1027 | 336 | 225 | 553 | 464 | 122 | 1027 | 272 | 267 | 863 | 153 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.25 | 0.25 | 0.25 | 0.44 | 0.44 | 0.44 | 0.33 | 0.33 | 0.33 | 0.47 | 0.47 | 0.47 |
| Crit Moves: | | | | | **** | | | | | | **** | |
| Green/Cycle: | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 |
| Volume/Cap: | 0.61 | 0.61 | 0.61 | 1.05 | 1.05 | 1.05 | 0.70 | 0.70 | 0.70 | 1.01 | 1.01 | 1.01 |
| Uniform Del: | 13.7 | 13.7 | 13.7 | 17.5 | 17.5 | 17.5 | 12.7 | 12.7 | 12.7 | 16.0 | 16.0 | 16.0 |
| IncremntDel: | 4.2 | 4.2 | 4.2 | 54.8 | 54.8 | 54.8 | 6.0 | 6.0 | 6.0 | 40.2 | 40.2 | 40.2 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 17.9 | 17.9 | 17.9 | 72.3 | 72.3 | 72.3 | 18.7 | 18.7 | 18.7 | 56.2 | 56.2 | 56.2 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 17.9 | 17.9 | 17.9 | 72.3 | 72.3 | 72.3 | 18.7 | 18.7 | 18.7 | 56.2 | 56.2 | 56.2 |
| LOS by Move: | B | B | B | E | E | E | B | B | B | E | E | E |
| HCM2kAvgQ: | 6 | 6 | 6 | 19 | 19 | 19 | 8 | 5 | 5 | 7 | 7 | 14 |





Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #14 Second / Folsom

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 2.236 |
| Loss Time (sec): | 7 | Average Delay (sec/veh): | 331.9 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Second | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permit+Prot | | | Split Phase | | | Split Phase | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 21 | 21 | 7 | 32 | 0 | 21 | 21 | 21 | 0 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1 1 | 0 | 1 | 0 1 | 0 | 0 | 2 0 | 1 | 0 | 0 0 | 1 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 402 | 138 | 248 | 1024 | 0 | 483 | 1288 | 172 | 0 | 0 | 228 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 402 | 138 | 248 | 1024 | 0 | 483 | 1288 | 172 | 0 | 0 | 228 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 410 | 141 | 253 | 1045 | 0 | 493 | 1314 | 176 | 0 | 0 | 233 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 410 | 141 | 253 | 1045 | 0 | 493 | 1314 | 176 | 0 | 0 | 233 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 410 | 141 | 253 | 1045 | 0 | 493 | 1314 | 176 | 0 | 0 | 233 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 0.81 | 0.81 | 0.13 | 0.44 | 1.00 | 0.79 | 0.50 | 0.72 | 1.00 | 1.00 | 0.78 |
| Lanes: | 0.00 | 1.49 | 0.51 | 1.00 | 1.00 | 0.00 | 0.57 | 2.43 | 1.00 | 0.00 | 0.00 | 1.00 |
| Final Sat.: | 0 | 2280 | 783 | 256 | 838 | 0 | 863 | 2301 | 1367 | 0 | 0 | 1479 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.18 | 0.18 | 0.99 | 1.25 | 0.00 | 0.57 | 0.57 | 0.13 | 0.00 | 0.00 | 0.16 |
| Crit Moves: | | | | | **** | | | **** | | | | **** |
| Green/Cycle: | 0.35 | 0.35 | 0.35 | 0.53 | 0.53 | 0.00 | 0.35 | 0.35 | 0.35 | 0.00 | 0.00 | 0.00 |
| Volume/Cap: | 0.00 | 0.51 | 0.51 | 1.97 | 2.35 | 0.00 | 1.63 | 1.63 | 0.37 | 0.00 | 0.00 | xxxx |
| Uniform Del: | 0.0 | 15.5 | 15.5 | 20.3 | 14.1 | 0.0 | 19.5 | 19.5 | 14.5 | 0.0 | 0.0 | 0.0 |
| IncremntDel: | 0.0 | 1.8 | 1.8 | 461.8 | 616 | 0.0 | 288.5 | 288 | 2.2 | 0.0 | 0.0 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Delay/Veh: | 0.0 | 17.2 | 17.2 | 482.1 | 630 | 0.0 | 308.0 | 308 | 16.7 | 0.0 | 0.0 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 17.2 | 17.2 | 482.1 | 630 | 0.0 | 308.0 | 308 | 16.7 | 0.0 | 0.0 | 0.0 |
| LOS by Move: | A | B | B | F | F | A | F | F | B | A | A | A |
| HCM2kAvgQ: | 0 | 5 | 5 | 22 | 94 | 0 | 64 | 41 | 2 | 0 | 0 | 4 |

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #15 First / Folsom

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.321 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 143.5 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | First | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 30 | 30 | 0 | 0 | 12 | 12 | 9 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 290 | 879 | 0 | 0 | 569 | 329 | 453 | 228 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 290 | 879 | 0 | 0 | 569 | 329 | 453 | 228 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 296 | 897 | 0 | 0 | 581 | 336 | 462 | 233 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 296 | 897 | 0 | 0 | 581 | 336 | 462 | 233 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 296 | 897 | 0 | 0 | 581 | 336 | 462 | 233 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 0.32 | 0.31 | 0.91 | 1.00 | 0.84 | 0.52 | 0.86 | 0.90 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 0.96 | 3.04 | 0.00 | 0.00 | 2.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 590 | 1788 | 0 | 0 | 3184 | 997 | 1625 | 1710 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.50 | 0.50 | 0.00 | 0.00 | 0.18 | 0.34 | 0.28 | 0.14 | 0.00 |
| Crit Moves: | | | | **** | | | | | **** | **** | | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.50 | 0.50 | 0.00 | 0.00 | 0.20 | 0.20 | 0.15 | 0.35 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.91 | 1.68 | 1.90 | 0.39 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 15.0 | 15.0 | 0.0 | 0.0 | 23.5 | 24.0 | 25.5 | 14.7 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 26.9 | 26.9 | 0.0 | 0.0 | 19.6 | 328.4 | 418.7 | 1.9 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 41.9 | 41.9 | 0.0 | 0.0 | 43.0 | 352.4 | 444.2 | 16.6 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 41.9 | 41.9 | 0.0 | 0.0 | 43.0 | 352.4 | 444.2 | 16.6 | 0.0 |
| LOS by Move: | A | A | A | D | D | A | A | D | F | F | B | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 12 | 12 | 0 | 0 | 9 | 25 | 37 | 3 | 0 |





Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #16 Fremont / Folsom / I-80 WB Off-Ramp

| | | | |
|---|---|---|---|
| Cycle (sec): | 75 | Critical Vol./Cap.(X): | 0.896 |
| Loss Time (sec): | 16 | Average Delay (sec/veh): | 187.9 |
| Optimal Cycle: | 96 | Level Of Service: | F |

| Street Name: | Fremont / I-80 WB Off-Ramp | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 19 | 19 | 19 | 19 | 0 | 21 | 21 | 21 | 0 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 32 | 32 | 15 | 290 | 103 | 0 | 216 | 510 | 183 | 0 | 649 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 32 | 32 | 15 | 290 | 103 | 0 | 216 | 510 | 183 | 0 | 649 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 33 | 33 | 15 | 296 | 105 | 0 | 220 | 520 | 187 | 0 | 662 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 33 | 33 | 15 | 296 | 105 | 0 | 220 | 520 | 187 | 0 | 662 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 33 | 33 | 15 | 296 | 105 | 0 | 220 | 520 | 187 | 0 | 662 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.80 | 0.80 | 0.80 | 0.86 | 0.90 | 1.00 | 0.49 | 0.49 | 0.49 | 0.95 | 0.86 | 0.95 |
| Lanes: | 0.81 | 0.81 | 0.38 | 1.00 | 1.00 | 0.00 | 0.48 | 1.12 | 0.40 | 0.00 | 2.00 | 0.00 |
| Final Sat.: | 1229 | 1229 | 576 | 1625 | 1710 | 0 | 444 | 1048 | 376 | 0 | 3249 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.03 | 0.03 | 0.03 | 0.18 | 0.06 | 0.00 | 0.50 | 0.50 | 0.50 | 0.00 | 0.20 | 0.00 |
| Crit Moves: | | **** | | **** | | | | **** | | | | |
| Green/Cycle: | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.28 | 0.28 | 0.28 | 0.00 | 0.28 | 0.00 |
| Volume/Cap: | 0.10 | 0.10 | 0.10 | 0.72 | 0.24 | 0.00 | 1.77 | 1.77 | 1.77 | 0.00 | 0.73 | 0.00 |
| Uniform Del: | 21.5 | 21.5 | 21.5 | 25.6 | 22.3 | 0.0 | 27.0 | 27.0 | 27.0 | 0.0 | 24.4 | 0.0 |
| IncremntDel: | 0.3 | 0.3 | 0.3 | 10.3 | 1.3 | 0.0 | 355.5 | 356 | 355.5 | 0.0 | 5.1 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| Delay/Veh: | 21.8 | 21.8 | 21.8 | 35.9 | 23.6 | 0.0 | 382.5 | 383 | 382.5 | 0.0 | 29.5 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 21.8 | 21.8 | 21.8 | 35.9 | 23.6 | 0.0 | 382.5 | 383 | 382.5 | 0.0 | 29.5 | 0.0 |
| LOS by Move: | C | C | C | D | C | A | F | F | F | A | C | A |
| HCM2kAvgQ: | 1 | 1 | 1 | 8 | 2 | 0 | 37 | 37 | 37 | 0 | 8 | 0 |

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #17 Beale / Folsom

Cycle (sec): 60 Critical Vol./Cap.(X): 1.722
Loss Time (sec): 8 Average Delay (sec/veh): 220.4
Optimal Cycle: 180 Level Of Service: F

| Street Name: | Beale | | | | | | | | | Folsom | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | | | | | | | |
| Movement: | L | - | T | - | R | L | - | T | - | R | L | - | T | - | R | L | - | T | - | R |
| Control: | Permitted | | | Permitted | | | Split Phase | | | Split Phase | | | | | | | | |
| Rights: | Include | | | Include | | | Include | | | Include | | | | | | | | |
| Min. Green: | 0 | 0 | 23 | 23 | 23 | 0 | 0 | 29 | 29 | 0 | 0 | 0 | | | | | | |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | | | | |
| Lanes: | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| Volume Module: | | | | | | | | | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 98 | 170 | 578 | 453 | 0 | 808 | 74 | 74 | 196 | 0 | | | | | | | | |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | |
| Initial Bse: | 0 | 0 | 98 | 170 | 578 | 453 | 0 | 808 | 74 | 74 | 196 | 0 | | | | | | | | |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | | | | | | | | |
| PHF Volume: | 0 | 0 | 100 | 173 | 590 | 462 | 0 | 824 | 76 | 76 | 200 | 0 | | | | | | | | |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| Reduced Vol: | 0 | 0 | 100 | 173 | 590 | 462 | 0 | 824 | 76 | 76 | 200 | 0 | | | | | | | | |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | |
| FinalVolume: | 0 | 0 | 100 | 173 | 590 | 462 | 0 | 824 | 76 | 76 | 200 | 0 | | | | | | | | |
| Saturation Flow Module: | | | | | | | | | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | | | | | | | | |
| Adjustment: | 1.00 | 1.00 | 0.75 | 0.71 | 0.71 | 0.71 | 1.00 | 0.25 | 0.25 | 0.84 | 0.84 | 1.00 | | | | | | | | |
| Lanes: | 1.00 | 0.00 | 1.00 | 0.28 | 0.97 | 0.75 | 0.00 | 1.83 | 0.17 | 0.55 | 1.45 | 0.00 | | | | | | | | |
| Final Sat.: | 1900 | 0 | 1424 | 384 | 1305 | 1023 | 0 | 864 | 79 | 878 | 2326 | 0 | | | | | | | | |
| Capacity Analysis Module: | | | | | | | | | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.07 | 0.45 | 0.45 | 0.45 | 0.00 | 0.95 | 0.95 | 0.09 | 0.09 | 0.00 | | | | | | | | |
| Crit Moves: | | | | | **** | | | **** | | | **** | | | | | | | | |
| Green/Cycle: | 0.00 | 0.00 | 0.38 | 0.38 | 0.38 | 0.38 | 0.00 | 0.48 | 0.48 | 0.00 | 0.00 | 0.00 | | | | | | | | |
| Volume/Cap: | 0.00 | 0.00 | 0.18 | 1.18 | 1.18 | 1.18 | 0.00 | 1.98 | 1.98 | xxxx | xxxx | 0.00 | | | | | | | | |
| Uniform Del: | 0.0 | 0.0 | 12.3 | 18.5 | 18.5 | 18.5 | 0.0 | 15.5 | 15.5 | 0.0 | 0.0 | 0.0 | | | | | | | | |
| IncremntDel: | 0.0 | 0.0 | 0.7 | 90.7 | 90.7 | 90.7 | 0.0 | 447 | 446.6 | 0.0 | 0.0 | 0.0 | | | | | | | | |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | | | | | | |
| Delay Adj: | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | | | | | | | | |
| Delay/Veh: | 0.0 | 0.0 | 13.0 | 109.2 | 109 | 109.2 | 0.0 | 462 | 462.1 | 0.0 | 0.0 | 0.0 | | | | | | | | |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | |
| AdjDel/Veh: | 0.0 | 0.0 | 13.0 | 109.2 | 109 | 109.2 | 0.0 | 462 | 462.1 | 0.0 | 0.0 | 0.0 | | | | | | | | |
| LOS by Move: | A | A | B | F | F | F | A | F | F | A | A | A | | | | | | | | |
| HCM2kAvgQ: | 0 | 0 | 1 | 28 | 28 | 28 | 0 | 39 | 39 | 2 | 2 | 0 | | | | | | | | |





Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #18 Main / Folsom

Cycle (sec): 60 Critical Vol./Cap.(X): 1.752
Loss Time (sec): 10 Average Delay (sec/veh): 201.2
Optimal Cycle: 180 Level Of Service: F

| Street Name: | Main | | | | | | | | | Folsom | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | | | | | | | |
| Movement: | L | - | T | - | R | L | - | T | - | R | L | - | T | - | R | L | - | T | - | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | | | | | | | |
| Rights: | Include | | | Include | | | Include | | | Include | | | | | | | | |
| Min. Green: | 0 | 19 | 19 | 0 | 0 | 0 | 31 | 31 | 31 | 31 | 0 | 31 | | | | | | |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | | | | |
| Lanes: | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1! | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | | | | | | | | | |
| Base Vol: | 196 | 172 | 31 | 74 | 271 | 149 | 45 | 979 | 343 | 5 | 0 | 217 | | | | | | | | |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | |
| Initial Bse: | 196 | 172 | 31 | 74 | 271 | 149 | 45 | 979 | 343 | 5 | 0 | 217 | | | | | | | | |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | | | | | | | | |
| PHF Volume: | 200 | 176 | 32 | 76 | 277 | 152 | 46 | 999 | 350 | 5 | 0 | 221 | | | | | | | | |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| Reduced Vol: | 200 | 176 | 32 | 76 | 277 | 152 | 46 | 999 | 350 | 5 | 0 | 221 | | | | | | | | |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | |
| FinalVolume: | 200 | 176 | 32 | 76 | 277 | 152 | 46 | 999 | 350 | 5 | 0 | 221 | | | | | | | | |
| Saturation Flow Module: | | | | | | | | | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | | | | | | | | |
| Adjustment: | 0.86 | 0.73 | 0.75 | 0.86 | 0.86 | 0.86 | 0.67 | 0.41 | 0.37 | 0.66 | 0.95 | 0.66 | | | | | | | | |
| Lanes: | 0.49 | 0.51 | 1.00 | 0.15 | 0.55 | 0.30 | 0.04 | 1.41 | 0.55 | 1.00 | 0.00 | 1.00 | | | | | | | | |
| Final Sat.: | 803 | 705 | 1424 | 244 | 893 | 491 | 51 | 1108 | 388 | 1262 | 0 | 1262 | | | | | | | | |
| Capacity Analysis Module: | | | | | | | | | | | | | | | | | | | | |
| Vol/Sat: | 0.25 | 0.25 | 0.02 | 0.31 | 0.31 | 0.31 | 0.90 | 0.90 | 0.90 | 0.00 | 0.00 | 0.18 | | | | | | | | |
| Crit Moves: | | **** | | | **** | | | **** | | | | | | | | | | | | |
| Green/Cycle: | 0.32 | 0.32 | 0.32 | 0.00 | 0.00 | 0.00 | 0.52 | 0.52 | 0.52 | 0.52 | 0.00 | 0.52 | | | | | | | | |
| Volume/Cap: | 0.79 | 0.79 | 0.07 | xxxx | xxxx | xxxx | 1.75 | 1.75 | 1.75 | 0.01 | 0.00 | 0.34 | | | | | | | | |
| Uniform Del: | 18.7 | 18.7 | 14.3 | 0.0 | 0.0 | 0.0 | 14.5 | 14.5 | 14.5 | 7.0 | 0.0 | 8.5 | | | | | | | | |
| IncremntDel: | 12.3 | 12.3 | 0.3 | 0.0 | 0.0 | 0.0 | 340.5 | 340 | 340.5 | 0.0 | 0.0 | 1.4 | | | | | | | | |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | | | | | | |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | | | | | | | | |
| Delay/Veh: | 31.0 | 31.0 | 14.6 | 0.0 | 0.0 | 0.0 | 355.0 | 355 | 355.0 | 7.0 | 0.0 | 9.9 | | | | | | | | |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | |
| AdjDel/Veh: | 31.0 | 31.0 | 14.6 | 0.0 | 0.0 | 0.0 | 355.0 | 355 | 355.0 | 7.0 | 0.0 | 9.9 | | | | | | | | |
| LOS by Move: | C | C | B | A | A | A | F | F | F | A | A | A | | | | | | | | |
| HCM2kAvgQ: | 8 | 7 | 0 | 8 | 8 | 8 | 87 | 54 | 50 | 0 | 0 | 3 | | | | | | | | |

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #19 Spear / Folsom

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 2.489 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 552.8 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Spear | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 23 | 23 | 23 | 0 | 29 | 29 | 29 | 29 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! 0 | 0 | 0 | 1! 0 | 0 | 1 | 0 1 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 23 | 23 | 137 | 164 | 328 | 82 | 292 | 676 | 55 | 19 | 107 | 65 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 23 | 23 | 137 | 164 | 328 | 82 | 292 | 676 | 55 | 19 | 107 | 65 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 23 | 23 | 140 | 167 | 335 | 84 | 298 | 690 | 56 | 19 | 109 | 66 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 23 | 23 | 140 | 167 | 335 | 84 | 298 | 690 | 56 | 19 | 109 | 66 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 23 | 23 | 140 | 167 | 335 | 84 | 298 | 690 | 56 | 19 | 109 | 66 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.75 | 0.75 | 0.75 | 0.29 | 0.29 | 0.29 | 0.66 | 0.20 | 0.20 | 0.68 | 0.68 | 0.68 |
| Lanes: | 0.12 | 0.13 | 0.75 | 0.29 | 0.57 | 0.14 | 0.21 | 1.66 | 0.13 | 0.20 | 1.12 | 0.68 |
| Final Sat.: | 179 | 179 | 1068 | 160 | 320 | 80 | 268 | 621 | 51 | 259 | 1457 | 885 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.13 | 0.13 | 0.13 | 1.05 | 1.05 | 1.05 | 1.11 | 1.11 | 1.11 | 0.07 | 0.07 | 0.07 |
| Crit Moves: | | | | | **** | | | | **** | | | |
| Green/Cycle: | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 |
| Volume/Cap: | 0.34 | 0.34 | 0.34 | 2.73 | 2.73 | 2.73 | 2.30 | 2.30 | 2.30 | 0.15 | 0.15 | 0.15 |
| Uniform Del: | 13.1 | 13.1 | 13.1 | 18.5 | 18.5 | 18.5 | 15.5 | 15.5 | 15.5 | 8.7 | 8.7 | 8.7 |
| IncremntDel: | 1.7 | 1.7 | 1.7 | 791.7 | 792 | 791.7 | 590.6 | 591 | 590.6 | 0.3 | 0.3 | 0.3 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 14.8 | 14.8 | 14.8 | 810.2 | 810 | 810.2 | 606.1 | 606 | 606.1 | 8.9 | 8.9 | 8.9 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 14.8 | 14.8 | 14.8 | 810.2 | 810 | 810.2 | 606.1 | 606 | 606.1 | 8.9 | 8.9 | 8.9 |
| LOS by Move: | B | B | B | F | F | F | F | F | F | A | A | A |
| HCM2kAvgQ: | 1 | 1 | 1 | 58 | 58 | 58 | 130 | 40 | 40 | 1 | 1 | 1 |

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Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #20 The Embarcadero / Folsom

| | | | |
|---|---|---|---|
| Cycle (sec): | 90 | Critical Vol./Cap.(X): | 1.191 |
| Loss Time (sec): | 10 | Average Delay (sec/veh): | 144.6 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | The Embarcadero | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Split Phase | | | Split Phase | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 12 | 49 | 0 | 0 | 32 | 32 | 31 | 0 | 31 | 0 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 1 | 0 | 2 0 | 0 | 0 | 1 1 | 0 | 1 | 0 0 | 1 | 0 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 249 | 2051 | 0 | 0 | 1596 | 32 | 541 | 0 | 377 | 0 | 0 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 249 | 2051 | 0 | 0 | 1596 | 32 | 541 | 0 | 377 | 0 | 0 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 254 | 2093 | 0 | 0 | 1629 | 33 | 552 | 0 | 385 | 0 | 0 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 254 | 2093 | 0 | 0 | 1629 | 33 | 552 | 0 | 385 | 0 | 0 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 254 | 2093 | 0 | 0 | 1629 | 33 | 552 | 0 | 385 | 0 | 0 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.93 | 0.74 | 1.00 | 1.00 | 1.02 | 0.93 | 0.93 | 1.00 | 0.83 | 1.00 | 1.00 | 1.00 |
| Lanes: | 1.00 | 2.00 | 0.00 | 0.00 | 1.96 | 0.04 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Final Sat.: | 1769 | 2802 | 0 | 0 | 3796 | 76 | 1769 | 0 | 1583 | 0 | 0 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.14 | 0.75 | 0.00 | 0.00 | 0.43 | 0.43 | 0.31 | 0.00 | 0.24 | 0.00 | 0.00 | 0.00 |
| Crit Moves: | | **** | | | **** | | | **** | | | | |
| Green/Cycle: | 0.13 | 0.54 | 0.00 | 0.00 | 0.35 | 0.35 | 0.34 | 0.00 | 0.34 | 0.00 | 0.00 | 0.00 |
| Volume/Cap: | 1.10 | 1.38 | 0.00 | 0.00 | 1.23 | 1.23 | 0.92 | 0.00 | 0.71 | 0.00 | 0.00 | 0.00 |
| Uniform Del: | 39.2 | 20.7 | 0.0 | 0.0 | 29.3 | 29.3 | 28.5 | 0.0 | 25.9 | 0.0 | 0.0 | 0.0 |
| IncremntDel: | 90.3 | 177 | 0.0 | 0.0 | 108 | 108.3 | 21.2 | 0.0 | 7.9 | 0.0 | 0.0 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Delay/Veh: | 129.5 | 197 | 0.0 | 0.0 | 138 | 137.6 | 49.7 | 0.0 | 33.8 | 0.0 | 0.0 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 129.5 | 197 | 0.0 | 0.0 | 138 | 137.6 | 49.7 | 0.0 | 33.8 | 0.0 | 0.0 | 0.0 |
| LOS by Move: | F | F | A | A | F | F | D | A | C | A | A | A |
| HCM2kAvgQ: | 10 | 66 | 0 | 0 | 42 | 39 | 14 | 0 | 9 | 0 | 0 | 0 |

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Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #21 Second / Harrison

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.480 |
| Loss Time (sec): | 10 | Average Delay (sec/veh): | 167.0 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Second | | | | | | Harrison | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 29 | 29 | 29 | 29 | 29 | 29 | 21 | 21 | 21 | 21 | 21 | 21 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 1 | 1 0 2 | 0 | 1 | 0 1 0 | 0 | 1 | 0 1 0 | 1 | 0 | 1 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 74 | 462 | 870 | 223 | 566 | 490 | 20 | 243 | 27 | 134 | 727 | 72 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 74 | 462 | 870 | 223 | 566 | 490 | 20 | 243 | 27 | 134 | 727 | 72 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 76 | 471 | 888 | 228 | 578 | 500 | 20 | 248 | 28 | 137 | 742 | 73 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 76 | 471 | 888 | 228 | 578 | 500 | 20 | 248 | 28 | 137 | 742 | 73 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 76 | 471 | 888 | 228 | 578 | 500 | 20 | 248 | 28 | 137 | 742 | 73 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.53 | 0.53 | 0.40 | 0.17 | 0.56 | 0.56 | 0.73 | 0.18 | 0.73 | 0.40 | 0.65 | 0.65 |
| Lanes: | 0.28 | 1.72 | 2.00 | 0.83 | 0.63 | 0.54 | 0.04 | 1.91 | 0.05 | 1.00 | 1.82 | 0.18 |
| Final Sat.: | 276 | 1724 | 1504 | 265 | 672 | 582 | 55 | 663 | 74 | 759 | 2260 | 224 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.27 | 0.27 | 0.59 | 0.86 | 0.86 | 0.86 | 0.37 | 0.37 | 0.37 | 0.18 | 0.33 | 0.33 |
| Crit Moves: | | | | | **** | | | **** | | | | |
| Green/Cycle: | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 |
| Volume/Cap: | 0.57 | 0.57 | 1.22 | 1.78 | 1.78 | 1.78 | 1.07 | 1.07 | 1.07 | 0.51 | 0.94 | 0.94 |
| Uniform Del: | 11.0 | 11.0 | 15.5 | 15.5 | 15.5 | 15.5 | 19.5 | 19.5 | 19.5 | 15.5 | 18.9 | 18.9 |
| IncremntDel: | 2.4 | 2.4 | 111.7 | 355.9 | 356 | 355.9 | 73.3 | 73.3 | 73.3 | 7.0 | 18.7 | 18.7 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 13.4 | 13.4 | 127.2 | 371.4 | 371 | 371.4 | 92.8 | 92.8 | 92.8 | 22.4 | 37.6 | 37.6 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 13.4 | 13.4 | 127.2 | 371.4 | 371 | 371.4 | 92.8 | 92.8 | 92.8 | 22.4 | 37.6 | 37.6 |
| LOS by Move: | B | B | F | F | F | F | F | F | F | C | D | D |
| HCM2kAvgQ: | 5 | 5 | 24 | 23 | 71 | 71 | 20 | 7 | 20 | 3 | 13 | 13 |

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Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #22 First / Harrison / I-80 EB On-Ramp

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.496 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 155.7 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | First | | | | | | Harrison | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permit+Prot | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 31 | 0 | 31 | 31 | 31 | 31 | 0 | 6 | 6 | 11 | 21 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! 0 | 0 | 1 | 0 2 | 0 | 1 | 0 1 | 0 | 0 | 1 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 1 | 0 | 1 | 21 | 1488 | 267 | 0 | 66 | 11 | 955 | 654 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 1 | 0 | 1 | 21 | 1488 | 267 | 0 | 66 | 11 | 955 | 654 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 1 | 0 | 1 | 21 | 1518 | 272 | 0 | 67 | 11 | 974 | 667 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 1 | 0 | 1 | 21 | 1518 | 272 | 0 | 67 | 11 | 974 | 667 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 1 | 0 | 1 | 21 | 1518 | 272 | 0 | 67 | 11 | 974 | 667 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.72 | 1.00 | 0.72 | 0.15 | 0.52 | 0.36 | 1.00 | 0.80 | 0.16 | 0.70 | 0.78 | 1.00 |
| Lanes: | 0.50 | 0.00 | 0.50 | 1.00 | 2.00 | 1.00 | 0.00 | 1.09 | 0.91 | 1.82 | 1.18 | 0.00 |
| Final Sat.: | 682 | 0 | 682 | 288 | 1990 | 685 | 0 | 1652 | 275 | 2422 | 1758 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.07 | 0.76 | 0.40 | 0.00 | 0.04 | 0.04 | 0.40 | 0.38 | 0.00 |
| Crit Moves: | | | | | **** | | | | | **** | | |
| Green/Cycle: | 0.52 | 0.00 | 0.52 | 0.52 | 0.52 | 0.52 | 0.10 | 0.10 | 0.10 | 0.35 | 0.35 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.14 | 1.47 | 0.76 | 0.00 | 0.41 | 0.41 | 1.27 | 1.08 | 0.00 |
| Uniform Del: | 6.9 | 0.0 | 6.9 | 7.5 | 14.4 | 11.5 | 0.0 | 25.3 | 25.3 | 22.6 | 19.5 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 2.0 | 215 | 14.5 | 0.0 | 6.3 | 6.3 | 126.6 | 49.8 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Delay/Veh: | 6.9 | 0.0 | 6.9 | 9.5 | 230 | 25.9 | 0.0 | 31.6 | 31.6 | 149.2 | 69.3 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 6.9 | 0.0 | 6.9 | 9.5 | 230 | 25.9 | 0.0 | 31.6 | 31.6 | 149.2 | 69.3 | 0.0 |
| LOS by Move: | A | A | A | A | F | C | A | C | C | F | E | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 0 | 48 | 6 | 0 | 2 | 1 | 24 | 16 | 0 |

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Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

**Intersection #23 Fremont / Harrison / I-80 WB Off-Ramp**

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.911 |
| Loss Time (sec): | 10 | Average Delay (sec/veh): | 80.1 |
| Optimal Cycle: | 83 | Level Of Service: | F |

| Street Name: | Fremont / I-80 WB Off-Ramp | | | | | | Harrison | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 0 | 0 | 21 | 29 | 29 | 0 | 0 | 29 | 29 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 0 | 0 | 279 | 5 | 89 | 0 | 0 | 1317 | 74 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 0 | 0 | 279 | 5 | 89 | 0 | 0 | 1317 | 74 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 0 | 0 | 285 | 5 | 91 | 0 | 0 | 1344 | 76 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 0 | 0 | 285 | 5 | 91 | 0 | 0 | 1344 | 76 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 0 | 0 | 285 | 5 | 91 | 0 | 0 | 1344 | 76 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.95 | 0.95 | 0.95 | 1.00 | 1.00 | 0.76 | 0.83 | 0.83 | 1.00 | 1.00 | 0.43 | 0.79 |
| Lanes: | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 1.00 | 0.05 | 0.95 | 0.00 | 0.00 | 2.91 | 0.09 |
| Final Sat.: | 0 | 0 | 3610 | 0 | 0 | 1435 | 84 | 1495 | 0 | 0 | 2397 | 135 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.06 | 0.06 | 0.00 | 0.00 | 0.56 | 0.56 |
| Crit Moves: | | | | | | **** | | | | | **** | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 | 0.48 | 0.48 | 0.00 | 0.00 | 0.48 | 0.48 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.57 | 0.13 | 0.13 | 0.00 | 0.00 | 1.16 | 1.16 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.8 | 8.5 | 8.5 | 0.0 | 0.0 | 15.5 | 15.5 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.6 | 0.3 | 0.3 | 0.0 | 0.0 | 81.4 | 81.4 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.4 | 8.9 | 8.9 | 0.0 | 0.0 | 96.9 | 96.9 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.4 | 8.9 | 8.9 | 0.0 | 0.0 | 96.9 | 96.9 |
| LOS by Move: | A | A | A | A | A | C | A | A | A | A | F | F |
| HCM2kAvgQ: | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 1 | 0 | 0 | 18 | 32 |





Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

**Intersection #24 Main / Harrison**

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.195 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 73.6 |
| Optimal Cycle: | 180 | Level Of Service: | E |

| Street Name: | Main | | | | | | Harrison | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 25 | 25 | 25 | 25 | 25 | 25 | 26 | 26 | 26 | 26 | 26 | 26 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1! | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | | | | | | | | | |
| Base Vol: | 239 | 316 | 22 | 5 | 242 | 205 | 12 | 44 | 28 | 7 | 846 | 41 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 239 | 316 | 22 | 5 | 242 | 205 | 12 | 44 | 28 | 7 | 846 | 41 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 244 | 322 | 22 | 5 | 247 | 209 | 12 | 45 | 29 | 7 | 863 | 42 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 244 | 322 | 22 | 5 | 247 | 209 | 12 | 45 | 29 | 7 | 863 | 42 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 244 | 322 | 22 | 5 | 247 | 209 | 12 | 45 | 29 | 7 | 863 | 42 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.25 | 0.87 | 0.87 | 0.88 | 0.88 | 0.31 | 0.75 | 0.75 | 0.75 | 0.73 | 0.31 | 0.73 |
| Lanes: | 1.00 | 0.93 | 0.07 | 0.02 | 0.98 | 1.00 | 0.14 | 0.53 | 0.33 | 0.01 | 2.93 | 0.06 |
| Final Sat.: | 475 | 1551 | 108 | 34 | 1632 | 598 | 204 | 747 | 475 | 14 | 1719 | 83 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.51 | 0.21 | 0.21 | 0.15 | 0.15 | 0.35 | 0.06 | 0.06 | 0.06 | 0.50 | 0.50 | 0.50 |
| Crit Moves: | **** | | | | | | | | | | **** | |
| Green/Cycle: | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 |
| Volume/Cap: | 1.23 | 0.50 | 0.50 | 0.36 | 0.36 | 0.84 | 0.14 | 0.14 | 0.14 | 1.16 | 1.16 | 1.16 |
| Uniform Del: | 17.5 | 12.9 | 12.9 | 12.0 | 12.0 | 15.7 | 10.2 | 10.2 | 10.2 | 17.0 | 17.0 | 17.0 |
| IncremntDel: | 140.3 | 2.6 | 2.6 | 1.5 | 1.5 | 27.3 | 0.5 | 0.5 | 0.5 | 85.6 | 85.6 | 85.6 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 157.8 | 15.5 | 15.5 | 13.5 | 13.5 | 43.0 | 10.7 | 10.7 | 10.7 | 102.6 | 103 | 102.6 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 157.8 | 15.5 | 15.5 | 13.5 | 13.5 | 43.0 | 10.7 | 10.7 | 10.7 | 102.6 | 103 | 102.6 |
| LOS by Move: | F | B | B | B | B | D | B | B | B | F | F | F |
| HCM2kAvgQ: | 13 | 5 | 5 | 3 | 3 | 3 | 1 | 1 | 1 | 26 | 11 | 26 |

Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #25 Spear / Harrison

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.203 |
| Loss Time (sec): | 10 | Average Delay (sec/veh): | 100.6 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Spear | | | | | | Harrison | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 21 | 0 | 21 | 21 | 21 | 21 | 0 | 29 | 29 | 29 | 29 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! 0 | 0 | 0 1 | 0 0 1 | 0 | 0 0 | 1 0 | 0 | 1 | 0 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 46 | 190 | 143 | 70 | 20 | 542 | 0 | 85 | 65 | 27 | 372 | 27 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 46 | 190 | 143 | 70 | 20 | 542 | 0 | 85 | 65 | 27 | 372 | 27 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 47 | 194 | 146 | 71 | 20 | 553 | 0 | 87 | 66 | 28 | 380 | 28 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 47 | 194 | 146 | 71 | 20 | 553 | 0 | 87 | 66 | 28 | 380 | 28 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 47 | 194 | 146 | 71 | 20 | 553 | 0 | 87 | 66 | 28 | 380 | 28 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.80 | 0.80 | 0.80 | 0.53 | 0.53 | 0.60 | 1.00 | 0.83 | 0.83 | 0.23 | 0.21 | 0.78 |
| Lanes: | 0.12 | 0.50 | 0.38 | 0.78 | 0.22 | 1.00 | 0.00 | 0.57 | 0.43 | 0.12 | 1.84 | 0.04 |
| Final Sat.: | 184 | 761 | 573 | 787 | 225 | 1140 | 0 | 895 | 684 | 53 | 733 | 53 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.25 | 0.25 | 0.25 | 0.09 | 0.09 | 0.49 | 0.00 | 0.10 | 0.10 | 0.52 | 0.52 | 0.52 |
| Crit Moves: | | | | | | **** | | | | | **** | |
| Green/Cycle: | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.00 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 |
| Volume/Cap: | 0.73 | 0.73 | 0.73 | 0.26 | 0.26 | 1.39 | 0.00 | 0.20 | 0.20 | 1.07 | 1.07 | 1.07 |
| Uniform Del: | 17.0 | 17.0 | 17.0 | 13.9 | 13.9 | 19.5 | 0.0 | 8.9 | 8.9 | 15.5 | 15.5 | 15.5 |
| IncremntDel: | 8.5 | 8.5 | 8.5 | 1.8 | 1.8 | 188.9 | 0.0 | 0.6 | 0.6 | 64.8 | 64.8 | 64.8 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 25.5 | 25.5 | 25.5 | 15.7 | 15.7 | 208.4 | 0.0 | 9.5 | 9.5 | 80.3 | 80.3 | 80.3 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 25.5 | 25.5 | 25.5 | 15.7 | 15.7 | 208.4 | 0.0 | 9.5 | 9.5 | 80.3 | 80.3 | 80.3 |
| LOS by Move: | C | C | C | B | B | F | A | A | A | F | F | F |
| HCM2kAvgQ: | 8 | 8 | 8 | 1 | 1 | 29 | 0 | 2 | 2 | 8 | 7 | 26 |





Level Of Service Computation Report
2000 HCM Operations Method (Base Volume Alternative)

Intersection #26 Second / Bryant

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.200 |
| Loss Time (sec): | 7 | Average Delay (sec/veh): | 68.0 |
| Optimal Cycle: | 180 | Level Of Service: | E |

| Street Name: | Second | | | | | | Bryant | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Split Phase | | | Split Phase | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 26 | 26 | 26 | 26 | 0 | 27 | 27 | 27 | 0 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 1 | 1 1 | 0 | 1 1 | 0 0 | 2 | 0 2 | 1 0 | 0 | 0 0 | 0 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 651 | 151 | 9 | 650 | 0 | 778 | 787 | 37 | 0 | 0 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 651 | 151 | 9 | 650 | 0 | 778 | 787 | 37 | 0 | 0 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 664 | 154 | 9 | 663 | 0 | 794 | 803 | 38 | 0 | 0 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 664 | 154 | 9 | 663 | 0 | 794 | 803 | 38 | 0 | 0 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 664 | 154 | 9 | 663 | 0 | 794 | 803 | 38 | 0 | 0 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 0.39 | 0.16 | 0.78 | 0.78 | 1.00 | 0.38 | 0.31 | 0.77 | 1.00 | 1.00 | 1.00 |
| Lanes: | 0.00 | 2.00 | 1.00 | 0.03 | 1.97 | 0.00 | 2.00 | 2.94 | 0.06 | 0.00 | 0.00 | 0.00 |
| Final Sat.: | 0 | 1491 | 298 | 41 | 2935 | 0 | 1462 | 1715 | 81 | 0 | 0 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.45 | 0.52 | 0.23 | 0.23 | 0.00 | 0.54 | 0.47 | 0.47 | 0.00 | 0.00 | 0.00 |
| Crit Moves: | | | **** | | | | **** | | | | | |
| Green/Cycle: | 0.00 | 0.43 | 0.43 | 0.43 | 0.43 | 0.00 | 0.45 | 0.45 | 0.45 | 0.00 | 0.00 | 0.00 |
| Volume/Cap: | 0.00 | 1.03 | 1.19 | 0.52 | 0.52 | 0.00 | 1.21 | 1.04 | 1.04 | 0.00 | 0.00 | 0.00 |
| Uniform Del: | 0.0 | 17.0 | 17.0 | 12.4 | 12.4 | 0.0 | 16.5 | 16.5 | 16.5 | 0.0 | 0.0 | 0.0 |
| IncremntDel: | 0.0 | 39.3 | 100.5 | 1.5 | 1.5 | 0.0 | 107.0 | 42.6 | 42.6 | 0.0 | 0.0 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Delay/Veh: | 0.0 | 56.3 | 117.5 | 14.0 | 14.0 | 0.0 | 123.5 | 59.1 | 59.1 | 0.0 | 0.0 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 56.3 | 117.5 | 14.0 | 14.0 | 0.0 | 123.5 | 59.1 | 59.1 | 0.0 | 0.0 | 0.0 |
| LOS by Move: | A | E | F | B | B | A | F | E | E | A | A | A |
| HCM2kAvgQ: | 0 | 13 | 9 | 5 | 5 | 0 | 20 | 12 | 24 | 0 | 0 | 0 |

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #1 First / Market / Battery / Bush

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.185 |
| Loss Time (sec): | 13 | Average Delay (sec/veh): | 118.7 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | First / Battery / Bush | | | | | | Market | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 18 | 18 | 18 | 0 | 29 | 29 | 29 | 29 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 113 | 1075 | 262 | 0 | 403 | 254 | 3 | 349 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 113 | 1075 | 262 | 0 | 403 | 254 | 3 | 349 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 78 | 0 | 0 | 0 | 7 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 113 | 1153 | 262 | 0 | 403 | 261 | 3 | 349 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 115 | 1177 | 267 | 0 | 411 | 266 | 3 | 356 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 115 | 1177 | 267 | 0 | 411 | 266 | 3 | 356 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 115 | 1177 | 267 | 0 | 411 | 266 | 3 | 356 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 0.64 | 0.71 | 0.56 | 1.00 | 0.73 | 0.28 | 0.73 | 0.73 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 1.00 | 2.00 | 2.00 | 0.00 | 1.00 | 1.00 | 0.02 | 1.98 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 1211 | 2706 | 2131 | 0 | 1384 | 540 | 24 | 2768 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.10 | 0.43 | 0.13 | 0.00 | 0.30 | 0.49 | 0.13 | 0.13 | 0.00 |
| Crit Moves: | | | | | **** | | | | **** | | | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.30 | 0.30 | 0.30 | 0.00 | 0.48 | 0.48 | 0.48 | 0.48 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.32 | 1.45 | 0.42 | 0.00 | 0.61 | 1.02 | 0.27 | 0.27 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 16.2 | 21.0 | 16.8 | 0.0 | 11.4 | 15.5 | 9.2 | 9.2 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 2.3 | 209 | 2.0 | 0.0 | 4.2 | 61.2 | 0.5 | 0.5 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 18.5 | 230 | 18.8 | 0.0 | 15.6 | 76.7 | 9.7 | 9.7 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 18.5 | 230 | 18.8 | 0.0 | 15.6 | 76.7 | 9.7 | 9.7 | 0.0 |
| LOS by Move: | A | A | A | B | F | B | A | B | E | A | A | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 2 | 41 | 3 | 0 | 7 | 11 | 2 | 2 | 0 |





Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #2 Fremont / Market / Front

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.284 |
| Loss Time (sec): | 11 | Average Delay (sec/veh): | 265.7 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Fremont / Front | | | | | | Market | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 27 | 27 | 27 | 0 | 0 | 0 | 22 | 22 | 0 | 0 | 22 | 22 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 63 | 1410 | 321 | 0 | 0 | 0 | 7 | 540 | 0 | 0 | 304 | 15 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 63 | 1410 | 321 | 0 | 0 | 0 | 7 | 540 | 0 | 0 | 304 | 15 |
| Added Vol: | 0 | 40 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 63 | 1450 | 325 | 0 | 0 | 0 | 7 | 540 | 0 | 0 | 304 | 15 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 64 | 1480 | 332 | 0 | 0 | 0 | 7 | 551 | 0 | 0 | 310 | 15 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 64 | 1480 | 332 | 0 | 0 | 0 | 7 | 551 | 0 | 0 | 310 | 15 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 64 | 1480 | 332 | 0 | 0 | 0 | 7 | 551 | 0 | 0 | 310 | 15 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.75 | 0.60 | 0.60 | 1.00 | 1.00 | 1.00 | 0.77 | 0.62 | 1.00 | 1.00 | 0.62 | 0.62 |
| Lanes: | 0.05 | 1.59 | 0.36 | 0.00 | 0.00 | 0.00 | 0.02 | 1.98 | 0.00 | 0.00 | 1.91 | 0.09 |
| Final Sat.: | 79 | 1822 | 408 | 0 | 0 | 0 | 30 | 2327 | 0 | 0 | 2248 | 111 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.81 | 0.81 | 0.81 | 0.00 | 0.00 | 0.00 | 0.24 | 0.24 | 0.00 | 0.00 | 0.14 | 0.14 |
| Crit Moves: | **** | | | | | | | **** | | | | |
| Green/Cycle: | 0.45 | 0.45 | 0.45 | 0.00 | 0.00 | 0.00 | 0.37 | 0.37 | 0.00 | 0.00 | 0.37 | 0.37 |
| Volume/Cap: | 1.80 | 1.80 | 1.80 | 0.00 | 0.00 | 0.00 | 0.65 | 0.65 | 0.00 | 0.00 | 0.38 | 0.38 |
| Uniform Del: | 382.5 | 16.5 | 16.5 | 0.0 | 0.0 | 0.0 | 15.8 | 15.8 | 0.0 | 0.0 | 14.0 | 14.0 |
| IncremntDel: | 366.0 | 366 | 366.0 | 0.0 | 0.0 | 0.0 | 3.7 | 3.7 | 0.0 | 0.0 | 1.3 | 1.3 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Delay/Veh: | 382.5 | 383 | 382.5 | 0.0 | 0.0 | 0.0 | 19.5 | 19.5 | 0.0 | 0.0 | 15.2 | 15.2 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 382.5 | 383 | 382.5 | 0.0 | 0.0 | 0.0 | 19.5 | 19.5 | 0.0 | 0.0 | 15.2 | 15.2 |
| LOS by Move: | F | F | F | A | A | A | B | B | A | A | B | B |
| HCM2kAvgQ: | 91 | 73 | 73 | 0 | 0 | 0 | 6 | 5 | 0 | 0 | 3 | 3 |

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #3 Second / Mission

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.908 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 28.8 |
| Optimal Cycle: | 81 | Level Of Service: | C |

| Street Name: | Second | | | | | | Mission | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 21 | 21 | 21 | 21 | 21 | 21 | 31 | 31 | 31 | 31 | 31 | 31 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 173 | 308 | 128 | 21 | 293 | 60 | 1 | 125 | 540 | 4 | 371 | 125 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 173 | 308 | 128 | 21 | 293 | 60 | 1 | 125 | 540 | 4 | 371 | 125 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 73 | 16 | 5 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 173 | 308 | 128 | 21 | 293 | 60 | 1 | 125 | 564 | 77 | 387 | 130 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 177 | 314 | 131 | 21 | 299 | 61 | 1 | 128 | 576 | 79 | 395 | 133 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 177 | 314 | 131 | 21 | 299 | 61 | 1 | 128 | 576 | 79 | 395 | 133 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 177 | 314 | 131 | 21 | 299 | 61 | 1 | 128 | 576 | 79 | 395 | 133 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.29 | 0.62 | 0.52 | 0.22 | 0.49 | 0.41 | 0.65 | 0.43 | 0.65 | 0.61 | 0.40 | 0.61 |
| Lanes: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.01 | 0.99 | 1.00 | 0.19 | 1.48 | 0.33 |
| Final Sat.: | 550 | 1173 | 997 | 416 | 922 | 783 | 7 | 816 | 1243 | 225 | 1132 | 380 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.32 | 0.27 | 0.13 | 0.05 | 0.32 | 0.08 | 0.16 | 0.16 | 0.46 | 0.35 | 0.35 | 0.35 |
| Crit Moves: | | | | | **** | | | | **** | | | |
| Green/Cycle: | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 |
| Volume/Cap: | 0.92 | 0.77 | 0.37 | 0.15 | 0.93 | 0.22 | 0.30 | 0.30 | 0.90 | 0.68 | 0.68 | 0.68 |
| Uniform Del: | 18.7 | 17.3 | 14.6 | 13.4 | 18.8 | 13.7 | 8.3 | 8.3 | 13.0 | 10.8 | 10.8 | 10.8 |
| IncremntDel: | 46.1 | 12.8 | 3.1 | 2.1 | 34.5 | 1.9 | 0.3 | 0.3 | 14.9 | 4.1 | 4.1 | 4.1 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 64.8 | 30.1 | 17.6 | 15.5 | 53.3 | 15.6 | 8.6 | 8.6 | 28.0 | 14.8 | 14.8 | 14.8 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 64.8 | 30.1 | 17.6 | 15.5 | 53.3 | 15.6 | 8.6 | 8.6 | 28.0 | 14.8 | 14.8 | 14.8 |
| LOS by Move: | E | C | B | B | D | B | A | A | C | B | B | B |
| HCM2kAvgQ: | 7 | 7 | 2 | 0 | 10 | 1 | 2 | 1 | 10 | 7 | 5 | 7 |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #4 First / Mission

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.504 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 327.1 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | First | | | | | | Mission | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 23 | 23 | 23 | 0 | 29 | 29 | 29 | 29 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 0 | 1536 | 382 | 0 | 0 | 269 | 0 | 0 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 0 | 1536 | 382 | 0 | 0 | 269 | 0 | 0 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 14 | 73 | 0 | 0 | 0 | 0 | 21 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 0 | 1550 | 455 | 0 | 0 | 269 | 0 | 21 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 0 | 1582 | 464 | 0 | 0 | 274 | 0 | 21 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 0 | 1582 | 464 | 0 | 0 | 274 | 0 | 21 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 0 | 1582 | 464 | 0 | 0 | 274 | 0 | 21 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 0.70 | 0.54 | 0.54 | 1.00 | 0.66 | 0.23 | 1.00 | 0.52 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 0.00 | 2.32 | 0.68 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 0 | 2392 | 702 | 0 | 0 | 428 | 0 | 988 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.00 | 0.66 | 0.66 | 0.00 | 0.00 | 0.64 | 0.00 | 0.02 | 0.00 |
| Crit Moves: | | | | | | **** | | | **** | | | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.00 | 0.38 | 0.38 | 0.00 | 0.00 | 0.48 | 0.00 | 0.48 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.00 | 1.73 | 1.73 | 0.00 | 0.00 | 1.33 | 0.00 | 0.04 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 0.0 | 18.5 | 18.5 | 0.0 | 0.0 | 15.5 | 0.0 | 8.2 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 0.0 | 330 | 329.9 | 0.0 | 0.0 | 177.2 | 0.0 | 0.2 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 348 | 348.4 | 0.0 | 0.0 | 192.7 | 0.0 | 8.4 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 348 | 348.4 | 0.0 | 0.0 | 192.7 | 0.0 | 8.4 | 0.0 |
| LOS by Move: | A | A | A | A | F | F | A | A | F | A | A | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 0 | 54 | 54 | 0 | 0 | 16 | 0 | 0 | 0 |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #5 Fremont / Mission

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.545 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 239.8 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Fremont | | | | | | Mission | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L - T - R | | | L - T - R | | | L - T - R | | | L - T - R | | |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 33 | 33 | 33 | 0 | 0 | 0 | 19 | 19 | 0 | 0 | 19 | 19 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 1 | 1 | 0 1 | 0 | 0 0 | 0 0 | 0 | 0 0 | 0 0 | 0 | 0 0 | 0 1 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 1536 | 495 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 1536 | 495 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Added Vol: | 21 | 43 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 21 | 1579 | 519 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 21 | 1611 | 530 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 105 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 21 | 1611 | 530 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 105 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 21 | 1611 | 530 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 105 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.42 | 0.63 | 0.22 | 1.00 | 1.00 | 1.00 | 1.00 | 0.66 | 1.00 | 1.00 | 0.66 | 0.74 |
| Lanes: | 0.04 | 1.96 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Final Sat.: | 31 | 2339 | 419 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1408 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.69 | 0.69 | 1.26 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 |
| Crit Moves: | | | **** | | | | | | | | | **** |
| Green/Cycle: | 0.55 | 0.55 | 0.55 | 0.00 | 0.00 | 0.00 | 0.32 | 0.32 | 0.00 | 0.00 | 0.32 | 0.32 |
| Volume/Cap: | 1.25 | 1.25 | 2.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.23 |
| Uniform Del: | 13.5 | 13.5 | 13.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.0 |
| IncremntDel: | 120.1 | 120 | 698.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Delay/Veh: | 133.6 | 134 | 611.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16.2 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 133.6 | 134 | 611.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16.2 |
| LOS by Move: | F | F | F | A | A | A | A | A | A | A | A | B |
| HCM2kAvgQ: | 24 | 48 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |





Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #6 Beale / Mission

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.003 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 178.2 |
| Optimal Cycle: | 131 | Level Of Service: | F |

| Street Name: | Beale | | | | | | Mission | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L - T - R | | | L - T - R | | | L - T - R | | | L - T - R | | |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 21 | 21 | 21 | 0 | 31 | 31 | 31 | 31 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 0 | 0 | 0 0 | 0 | 1 1 | 0 1 | 0 | 0 1 | 0 1 | 1 | 0 1 | 0 1 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 60 | 1610 | 19 | 0 | 275 | 258 | 281 | 48 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 60 | 1610 | 19 | 0 | 275 | 258 | 281 | 48 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 24 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 60 | 1614 | 19 | 0 | 299 | 258 | 281 | 48 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 61 | 1647 | 19 | 0 | 305 | 263 | 287 | 49 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 61 | 1647 | 19 | 0 | 305 | 263 | 287 | 49 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 61 | 1647 | 19 | 0 | 305 | 263 | 287 | 49 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 0.83 | 0.83 | 0.75 | 1.00 | 0.57 | 0.73 | 0.46 | 0.57 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 0.07 | 1.93 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Final Sat.: | 0 | 0 | 0 | 114 | 3055 | 1424 | 0 | 1074 | 1384 | 869 | 1074 | 1900 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.54 | 0.54 | 0.01 | 0.00 | 0.28 | 0.19 | 0.33 | 0.05 | 0.00 |
| Crit Moves: | | | | | **** | | | | | **** | | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.35 | 0.35 | 0.35 | 0.00 | 0.52 | 0.52 | 0.52 | 0.52 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 1.54 | 1.54 | 0.04 | 0.00 | 0.55 | 0.37 | 0.64 | 0.09 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 19.5 | 19.5 | 12.8 | 0.0 | 9.8 | 8.7 | 10.5 | 7.3 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 247.8 | 248 | 0.1 | 0.0 | 3.9 | 1.5 | 6.8 | 0.3 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 267.3 | 267 | 13.0 | 0.0 | 13.7 | 10.1 | 17.2 | 7.7 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 267.3 | 267 | 13.0 | 0.0 | 13.7 | 10.1 | 17.2 | 7.7 | 0.0 |
| LOS by Move: | A | A | A | F | F | B | A | B | B | B | A | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 57 | 57 | 0 | 0 | 5 | 3 | 5 | 1 | 0 |

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #7 Main / Mission

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.879 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 103.0 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Main | | | | | | Mission | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permit+Prot | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 21 | 21 | 21 | 0 | 0 | 0 | 8 | 31 | 0 | 0 | 19 | 19 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! 0 | 0 | 0 | 1 0 | 1 | 0 | 1 1 | 0 | 1 | 0 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 180 | 427 | 173 | 110 | 343 | 0 | 48 | 296 | 0 | 55 | 173 | 79 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 180 | 427 | 173 | 110 | 343 | 0 | 48 | 296 | 0 | 55 | 173 | 79 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 180 | 427 | 173 | 110 | 343 | 0 | 48 | 320 | 0 | 55 | 173 | 79 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 184 | 436 | 177 | 112 | 350 | 0 | 49 | 327 | 0 | 56 | 177 | 81 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 184 | 436 | 177 | 112 | 350 | 0 | 49 | 327 | 0 | 56 | 177 | 81 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 184 | 436 | 177 | 112 | 350 | 0 | 49 | 327 | 0 | 56 | 177 | 81 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.81 | 0.81 | 0.81 | 0.87 | 0.87 | 1.00 | 0.47 | 0.81 | 0.95 | 0.77 | 0.77 | 0.77 |
| Lanes: | 0.23 | 0.55 | 0.22 | 0.24 | 0.76 | 0.00 | 1.00 | 2.00 | 0.00 | 0.36 | 1.13 | 0.51 |
| Final Sat.: | 356 | 845 | 342 | 402 | 1254 | 0 | 892 | 3093 | 0 | 522 | 1643 | 750 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.52 | 0.52 | 0.52 | 0.28 | 0.28 | 0.00 | 0.05 | 0.11 | 0.00 | 0.11 | 0.11 | 0.11 |
| Crit Moves: | | | **** | **** | | | **** | | | | **** | |
| Green/Cycle: | 0.35 | 0.35 | 0.35 | 0.00 | 0.00 | 0.00 | 0.51 | 0.51 | 0.00 | 0.00 | 0.31 | 0.31 |
| Volume/Cap: | 1.47 | 1.47 | 1.47 | xxxx | xxxx | 0.00 | 0.09 | 0.21 | 0.00 | xxxx | 0.35 | 0.35 |
| Uniform Del: | 19.5 | 19.5 | 19.5 | 0.0 | 0.0 | 0.0 | 9.4 | 8.1 | 0.0 | 0.0 | 16.0 | 16.0 |
| IncremntDel: | 223.0 | 223 | 223.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 1.1 | 1.1 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Delay/Veh: | 242.5 | 242 | 242.5 | 0.0 | 0.0 | 0.0 | 9.8 | 8.4 | 0.0 | 0.0 | 17.1 | 17.1 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 242.5 | 242 | 242.5 | 0.0 | 0.0 | 0.0 | 9.8 | 8.4 | 0.0 | 0.0 | 17.1 | 17.1 |
| LOS by Move: | F | F | F | A | A | A | A | A | A | A | B | B |
| HCM2kAvgQ: | 48 | 48 | 48 | 8 | 8 | 0 | 1 | 2 | 0 | 3 | 2 | 2 |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #8 Second / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 5.214 |
| Loss Time (sec): | 7 | Average Delay (sec/veh): | 898.0 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Second | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Split Phase | | | Split Phase | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 21 | 21 | 0 | 0 | 21 | 21 | 0 | 0 | 0 | 32 | 32 | 32 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 1 | 0 | 0 1 0 | 1 | 0 | 0 1 0 | 0 | 0 | 0 0 0 | 0 | 1 | 0 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 441 | 405 | 387 | 0 | 446 | 527 | 0 | 0 | 0 | 617 | 2474 | 162 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 441 | 405 | 387 | 0 | 446 | 527 | 0 | 0 | 0 | 617 | 2474 | 162 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 63 | 122 | 5 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 441 | 405 | 387 | 0 | 446 | 527 | 0 | 0 | 0 | 680 | 2596 | 167 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 450 | 413 | 395 | 0 | 455 | 538 | 0 | 0 | 0 | 694 | 2649 | 170 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 450 | 413 | 395 | 0 | 455 | 538 | 0 | 0 | 0 | 694 | 2649 | 170 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 450 | 413 | 395 | 0 | 455 | 538 | 0 | 0 | 0 | 694 | 2649 | 170 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.08 | 0.42 | 0.82 | 0.75 | 0.44 | 0.44 | 1.00 | 1.00 | 1.00 | 0.60 | 0.60 | 0.60 |
| Lanes: | 1.00 | 0.67 | 0.33 | 1.00 | 0.46 | 0.54 | 0.00 | 0.00 | 0.00 | 0.39 | 1.51 | 0.10 |
| Final Sat.: | 146 | 533 | 509 | 1425 | 379 | 448 | 0 | 0 | 0 | 452 | 1727 | 111 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 3.07 | 0.78 | 0.78 | 0.00 | 1.20 | 1.20 | 0.00 | 0.00 | 0.00 | 1.53 | 1.53 | 1.53 |
| Crit Moves: | **** | | | | | | | | | | | **** |
| Green/Cycle: | 0.35 | 0.35 | 0.35 | 0.00 | 0.35 | 0.35 | 0.00 | 0.00 | 0.00 | 0.53 | 0.53 | 0.53 |
| Volume/Cap: | 3.75 | 2.22 | 2.22 | 0.00 | 3.43 | 3.43 | 0.00 | 0.00 | 0.00 | 2.88 | 2.88 | 2.88 |
| Uniform Del: | 19.5 | 19.5 | 19.5 | 0.0 | 19.5 | 19.5 | 0.0 | 0.0 | 0.0 | 14.0 | 14.0 | 14.0 |
| IncremntDel: | 1258 | 556 | 556.3 | 0.0 | 1103 | 1103 | 0.0 | 0.0 | 0.0 | 846.2 | 846 | 846.2 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 1277 | 576 | 575.8 | 0.0 | 1122 | 1122 | 0.0 | 0.0 | 0.0 | 860.2 | 860 | 860.2 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 1277 | 576 | 575.8 | 0.0 | 1122 | 1122 | 0.0 | 0.0 | 0.0 | 860.2 | 860 | 860.2 |
| LOS by Move: | F | F | F | A | F | F | A | A | A | F | F | F |
| HCM2kAvgQ: | 50 | 54 | 105 | 0 | 106 | 106 | 0 | 0 | 0 | 183 | 183 | 183 |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #9 First / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 2.546 |
| Loss Time (sec): | 11 | Average Delay (sec/veh): | 493.5 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | First | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 0 | 25 | 25 | 0 | 0 | 0 | 24 | 24 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 2 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 76 | 1144 | 1093 | 0 | 710 | 80 | 0 | 1869 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 76 | 1144 | 1093 | 0 | 710 | 80 | 0 | 1869 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 37 | 190 | 0 | 0 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 76 | 1181 | 1283 | 0 | 710 | 80 | 0 | 1869 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 78 | 1205 | 1309 | 0 | 724 | 82 | 0 | 1907 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 78 | 1205 | 1309 | 0 | 724 | 82 | 0 | 1907 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 78 | 1205 | 1309 | 0 | 724 | 82 | 0 | 1907 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 0.75 | 0.44 | 0.52 | 1.00 | 0.89 | 0.89 | 0.65 | 0.67 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 1.00 | 2.00 | 1.00 | 0.00 | 0.90 | 0.10 | 0.00 | 2.00 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 1424 | 1687 | 984 | 0 | 1515 | 171 | 0 | 2547 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.05 | 0.71 | 1.33 | 0.00 | 0.48 | 0.48 | 0.00 | 0.75 | 0.00 |
| Crit Moves: | | | | | | **** | | | | | **** | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.42 | 0.42 | 0.42 | 0.00 | 0.40 | 0.40 | 0.00 | 0.40 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.13 | 1.71 | 3.19 | 0.00 | 1.20 | 1.20 | 0.00 | 1.87 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 16.8 | 17.5 | 17.5 | 0.0 | 18.0 | 18.0 | 0.0 | 18.0 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 0.1 | 324 | 989.9 | 0.0 | 102 | 102.0 | 0.0 | 396 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 17.0 | 342 | 1007 | 0.0 | 120 | 120.0 | 0.0 | 414 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 17.0 | 342 | 1007 | 0.0 | 120 | 120.0 | 0.0 | 414 | 0.0 |
| LOS by Move: | A | A | A | B | F | F | A | F | F | A | F | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 1 | 48 | 149 | 0 | 35 | 35 | 0 | 75 | 0 |





Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #10 Fremont / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 4.395 |
| Loss Time (sec): | 12 | Average Delay (sec/veh): | 462.0 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Fremont | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 21 | 21 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 27 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 580 | 1312 | 339 | 0 | 0 | 0 | 407 | 221 | 0 | 0 | 1512 | 159 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 580 | 1312 | 339 | 0 | 0 | 0 | 407 | 221 | 0 | 0 | 1512 | 159 |
| Added Vol: | 0 | 289 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 580 | 1601 | 339 | 0 | 0 | 0 | 407 | 221 | 0 | 0 | 1512 | 172 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 592 | 1634 | 346 | 0 | 0 | 0 | 415 | 226 | 0 | 0 | 1543 | 176 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 592 | 1634 | 346 | 0 | 0 | 0 | 415 | 226 | 0 | 0 | 1543 | 176 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 592 | 1634 | 346 | 0 | 0 | 0 | 415 | 226 | 0 | 0 | 1543 | 176 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.75 | 0.78 | 0.78 | 1.00 | 1.00 | 1.00 | 0.11 | 0.11 | 1.00 | 1.00 | 0.82 | 0.82 |
| Lanes: | 1.00 | 2.48 | 0.52 | 0.00 | 0.00 | 0.00 | 0.65 | 0.35 | 0.00 | 0.00 | 1.80 | 0.20 |
| Final Sat.: | 1424 | 3677 | 779 | 0 | 0 | 0 | 135 | 73 | 0 | 0 | 2805 | 319 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.42 | 0.44 | 0.44 | 0.00 | 0.00 | 0.00 | 3.07 | 3.07 | 0.00 | 0.00 | 0.55 | 0.55 |
| Crit Moves: | | **** | | | | | | **** | | | | |
| Green/Cycle: | 0.35 | 0.35 | 0.35 | 0.00 | 0.00 | 0.00 | 0.45 | 0.45 | 0.00 | 0.00 | 0.45 | 0.45 |
| Volume/Cap: | 1.19 | 1.27 | 1.27 | 0.00 | 0.00 | 0.00 | 6.83 | 6.83 | 0.00 | 0.00 | 1.22 | 1.22 |
| Uniform Del: | 19.5 | 19.5 | 19.5 | 0.0 | 0.0 | 0.0 | 16.5 | 16.5 | 0.0 | 0.0 | 16.5 | 16.5 |
| IncremntDel: | 102.9 | 126 | 126.4 | 0.0 | 0.0 | 0.0 | 2644 | 2644 | 0.0 | 0.0 | 107 | 106.7 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Delay/Veh: | 122.4 | 146 | 145.9 | 0.0 | 0.0 | 0.0 | 2660 | 2660 | 0.0 | 0.0 | 123 | 123.2 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 122.4 | 146 | 145.9 | 0.0 | 0.0 | 0.0 | 2660 | 2660 | 0.0 | 0.0 | 123 | 123.2 |
| LOS by Move: | F | F | F | A | A | A | F | F | A | A | F | F |
| HCM2kAvgQ: | 26 | 35 | 35 | 0 | 0 | 0 | 80 | 80 | 0 | 0 | 40 | 40 |

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #11 Beale / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.771 |
| Loss Time (sec): | 10 | Average Delay (sec/veh): | 222.7 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Beale | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 31 | 31 | 31 | 0 | 19 | 19 | 19 | 19 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 158 | 994 | 894 | 0 | 590 | 55 | 0 | 594 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 158 | 994 | 894 | 0 | 590 | 55 | 0 | 594 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 9 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 158 | 994 | 898 | 0 | 590 | 55 | 0 | 603 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 161 | 1014 | 916 | 0 | 602 | 56 | 0 | 615 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 161 | 1014 | 916 | 0 | 602 | 56 | 0 | 615 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 161 | 1014 | 916 | 0 | 602 | 56 | 0 | 615 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 1.25 | 0.78 | 0.44 | 1.00 | 0.89 | 0.89 | 0.95 | 0.67 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.91 | 0.09 | 0.00 | 2.00 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 2379 | 1479 | 843 | 0 | 1547 | 144 | 0 | 2537 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.07 | 0.69 | 1.09 | 0.00 | 0.39 | 0.39 | 0.00 | 0.24 | 0.00 |
| Crit Moves: | | | | | | **** | | **** | | | | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.52 | 0.52 | 0.52 | 0.00 | 0.32 | 0.32 | 0.00 | 0.32 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.13 | 1.33 | 2.10 | 0.00 | 1.23 | 1.23 | 0.00 | 0.77 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 7.5 | 14.5 | 14.5 | 0.0 | 20.5 | 20.5 | 0.0 | 18.5 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 0.2 | 152 | 500.4 | 0.0 | 119 | 118.7 | 0.0 | 6.9 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 7.7 | 167 | 514.9 | 0.0 | 139 | 139.2 | 0.0 | 25.4 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 7.7 | 167 | 514.9 | 0.0 | 139 | 139.2 | 0.0 | 25.4 | 0.0 |
| LOS by Move: | A | A | A | A | F | F | A | F | F | A | C | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 2 | 54 | 81 | 0 | 31 | 31 | 0 | 7 | 0 |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #12 Main / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 3.376 |
| Loss Time (sec): | 7 | Average Delay (sec/veh): | 523.9 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Main | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 20 | 20 | 20 | 0 | 0 | 0 | 33 | 33 | 0 | 0 | 25 | 25 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 87 | 779 | 17 | 0 | 409 | 0 | 205 | 381 | 0 | 87 | 446 | 70 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 87 | 779 | 17 | 0 | 409 | 0 | 205 | 381 | 0 | 87 | 446 | 70 |
| Added Vol: | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 90 | 779 | 17 | 0 | 409 | 0 | 205 | 381 | 0 | 87 | 453 | 70 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 92 | 795 | 17 | 0 | 417 | 0 | 209 | 389 | 0 | 89 | 462 | 71 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 92 | 795 | 17 | 0 | 417 | 0 | 209 | 389 | 0 | 89 | 462 | 71 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 92 | 795 | 17 | 0 | 417 | 0 | 209 | 389 | 0 | 89 | 462 | 71 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.81 | 0.81 | 0.81 | 1.00 | 0.90 | 1.00 | 0.13 | 0.13 | 0.25 | 0.26 | 0.26 | 0.26 |
| Lanes: | 0.10 | 0.88 | 0.02 | 0.00 | 1.00 | 0.00 | 0.35 | 0.65 | 0.00 | 0.28 | 1.49 | 0.23 |
| Final Sat.: | 157 | 1359 | 30 | 0 | 1710 | 0 | 87 | 162 | 0 | 138 | 721 | 111 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.58 | 0.58 | 0.58 | 0.00 | 0.24 | 0.00 | 2.40 | 2.40 | 0.00 | 0.64 | 0.64 | 0.64 |
| Crit Moves: | | **** | | | | | | **** | | | | |
| Green/Cycle: | 0.33 | 0.33 | 0.33 | 0.00 | 0.33 | 0.00 | 0.55 | 0.55 | 0.00 | 0.55 | 0.55 | 0.55 |
| Volume/Cap: | 1.75 | 1.75 | 1.75 | 0.00 | 0.73 | 0.00 | 4.36 | 4.36 | 0.00 | 1.17 | 1.17 | 1.17 |
| Uniform Del: | 20.0 | 20.0 | 20.0 | 0.0 | 17.6 | 0.0 | 13.5 | 13.5 | 0.0 | 13.5 | 13.5 | 13.5 |
| IncremntDel: | 347.3 | 347 | 347.3 | 0.0 | 8.1 | 0.0 | 1529 | 1529 | 0.0 | 93.6 | 93.6 | 93.6 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 367.3 | 367 | 367.3 | 0.0 | 25.7 | 0.0 | 1542 | 1542 | 0.0 | 107.1 | 107 | 107.1 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 367.3 | 367 | 367.3 | 0.0 | 25.7 | 0.0 | 1542 | 1542 | 0.0 | 107.1 | 107 | 107.1 |
| LOS by Move: | F | F | F | A | C | A | F | F | A | F | F | F |
| HCM2kAvgQ: | 66 | 66 | 66 | 0 | 9 | 0 | 69 | 69 | 0 | 15 | 15 | 15 |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #13 Spear / Howard

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.040 |
| Loss Time (sec): | 7 | Average Delay (sec/veh): | 45.8 |
| Optimal Cycle: | 180 | Level Of Service: | D |

| Street Name: | Spear | | | | | | Howard | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 25 | 25 | 25 | 0 | 28 | 28 | 28 | 28 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! 0 | 0 | 0 | 1! 0 | 0 | 1 | 0 1 | 0 | 1 | 0 1 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 42 | 254 | 83 | 97 | 238 | 200 | 39 | 328 | 87 | 124 | 400 | 71 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 42 | 254 | 83 | 97 | 238 | 200 | 39 | 328 | 87 | 124 | 400 | 71 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 5 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 42 | 254 | 83 | 97 | 238 | 202 | 39 | 328 | 87 | 124 | 405 | 71 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 43 | 259 | 85 | 99 | 243 | 206 | 40 | 335 | 89 | 127 | 413 | 72 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 43 | 259 | 85 | 99 | 243 | 206 | 40 | 335 | 89 | 127 | 413 | 72 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 43 | 259 | 85 | 99 | 243 | 206 | 40 | 335 | 89 | 127 | 413 | 72 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.81 | 0.81 | 0.81 | 0.65 | 0.65 | 0.65 | 0.72 | 0.36 | 0.36 | 0.32 | 0.32 | 0.64 |
| Lanes: | 0.11 | 0.67 | 0.22 | 0.18 | 0.44 | 0.38 | 0.09 | 1.51 | 0.40 | 0.44 | 1.43 | 0.13 |
| Final Sat.: | 170 | 1026 | 335 | 224 | 550 | 467 | 122 | 1026 | 272 | 265 | 866 | 152 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.25 | 0.25 | 0.25 | 0.44 | 0.44 | 0.44 | 0.33 | 0.33 | 0.33 | 0.48 | 0.48 | 0.48 |
| Crit Moves: | | | | | **** | | | | | | **** | |
| Green/Cycle: | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 |
| Volume/Cap: | 0.61 | 0.61 | 0.61 | 1.06 | 1.06 | 1.06 | 0.70 | 0.70 | 0.70 | 1.02 | 1.02 | 1.02 |
| Uniform Del: | 13.7 | 13.7 | 13.7 | 17.5 | 17.5 | 17.5 | 12.7 | 12.7 | 12.7 | 16.0 | 16.0 | 16.0 |
| IncremntDel: | 4.2 | 4.2 | 4.2 | 56.4 | 56.4 | 56.4 | 6.0 | 6.0 | 6.0 | 42.7 | 42.7 | 42.7 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 17.9 | 17.9 | 17.9 | 73.9 | 73.9 | 73.9 | 18.7 | 18.7 | 18.7 | 58.7 | 58.7 | 58.7 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 17.9 | 17.9 | 17.9 | 73.9 | 73.9 | 73.9 | 18.7 | 18.7 | 18.7 | 58.7 | 58.7 | 58.7 |
| LOS by Move: | B | B | B | E | E | E | B | B | B | E | E | E |
| HCM2kAvgQ: | 3 | 8 | 3 | 10 | 20 | 20 | 8 | 5 | 5 | 8 | 8 | 15 |





Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #14 Second / Folsom

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 2.358 |
| Loss Time (sec): | 7 | Average Delay (sec/veh): | 374.2 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Second | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permit+Prot | | | Split Phase | | | Split Phase | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 21 | 21 | 7 | 32 | 0 | 21 | 21 | 21 | 0 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1 1 | 0 | 1 | 0 1 | 0 | 1 | 2 0 | 1 | 0 | 0 0 1 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 402 | 138 | 248 | 1024 | 0 | 483 | 1288 | 172 | 0 | 0 | 228 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 402 | 138 | 248 | 1024 | 0 | 483 | 1288 | 172 | 0 | 0 | 228 |
| Added Vol: | 0 | 0 | 70 | 9 | 55 | 0 | 0 | 113 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 402 | 208 | 257 | 1079 | 0 | 483 | 1401 | 172 | 0 | 0 | 228 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 410 | 212 | 262 | 1101 | 0 | 493 | 1430 | 176 | 0 | 0 | 233 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 410 | 212 | 262 | 1101 | 0 | 493 | 1430 | 176 | 0 | 0 | 233 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 410 | 212 | 262 | 1101 | 0 | 493 | 1430 | 176 | 0 | 0 | 233 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 0.80 | 0.80 | 0.12 | 0.44 | 1.00 | 0.79 | 0.50 | 0.72 | 1.00 | 1.00 | 0.78 |
| Lanes: | 0.00 | 1.32 | 0.68 | 1.00 | 1.00 | 0.00 | 0.54 | 2.46 | 1.00 | 0.00 | 0.00 | 1.00 |
| Final Sat.: | 0 | 1991 | 1030 | 236 | 838 | 0 | 806 | 2337 | 1367 | 0 | 0 | 1479 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.21 | 0.21 | 1.11 | 1.31 | 0.00 | 0.61 | 0.61 | 0.13 | 0.00 | 0.00 | 0.16 |
| Crit Moves: | | | | | **** | | **** | | | | | **** |
| Green/Cycle: | 0.35 | 0.35 | 0.35 | 0.53 | 0.53 | 0.00 | 0.35 | 0.35 | 0.35 | 0.00 | 0.00 | 0.00 |
| Volume/Cap: | 0.00 | 0.59 | 0.59 | 2.20 | 2.48 | 0.00 | 1.75 | 1.75 | 0.37 | 0.00 | 0.00 | xxxx |
| Uniform Del: | 0.0 | 16.0 | 16.0 | 20.9 | 14.1 | 0.0 | 19.5 | 19.5 | 14.5 | 0.0 | 0.0 | 0.0 |
| IncremntDel: | 0.0 | 2.4 | 2.4 | 564.6 | 672 | 0.0 | 340.2 | 340 | 2.2 | 0.0 | 0.0 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Delay/Veh: | 0.0 | 18.4 | 18.4 | 585.5 | 687 | 0.0 | 359.7 | 360 | 16.7 | 0.0 | 0.0 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 18.4 | 18.4 | 585.5 | 687 | 0.0 | 359.7 | 360 | 16.7 | 0.0 | 0.0 | 0.0 |
| LOS by Move: | A | B | B | F | F | A | F | F | B | A | A | A |
| HCM2kAvgQ: | 0 | 6 | 6 | 24 | 102 | 0 | 73 | 47 | 2 | 0 | 0 | 4 |

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #15 First / Folsom

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.339 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 162.1 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | First | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Protected | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 30 | 30 | 0 | 0 | 12 | 12 | 9 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 290 | 879 | 0 | 0 | 569 | 329 | 453 | 228 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 290 | 879 | 0 | 0 | 569 | 329 | 453 | 228 | 0 |
| Added Vol: | 0 | 0 | 0 | 5 | 31 | 0 | 0 | 185 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 295 | 910 | 0 | 0 | 754 | 329 | 453 | 228 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 301 | 929 | 0 | 0 | 769 | 336 | 462 | 233 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 301 | 929 | 0 | 0 | 769 | 336 | 462 | 233 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 301 | 929 | 0 | 0 | 769 | 336 | 462 | 233 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 1.00 | 1.00 | 0.32 | 0.31 | 0.91 | 1.00 | 0.84 | 0.52 | 0.86 | 0.90 | 1.00 |
| Lanes: | 0.00 | 0.00 | 0.00 | 0.94 | 3.06 | 0.00 | 0.00 | 2.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Final Sat.: | 0 | 0 | 0 | 582 | 1795 | 0 | 0 | 3184 | 997 | 1625 | 1710 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.52 | 0.52 | 0.00 | 0.00 | 0.24 | 0.34 | 0.28 | 0.14 | 0.00 |
| Crit Moves: | | | | | **** | | | | **** | **** | | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.50 | 0.50 | 0.00 | 0.00 | 0.20 | 0.20 | 0.15 | 0.35 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 1.03 | 1.03 | 0.00 | 0.00 | 1.21 | 1.68 | 1.90 | 0.39 | 0.00 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 15.0 | 15.0 | 0.0 | 0.0 | 24.0 | 24.0 | 25.5 | 14.7 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 35.4 | 35.4 | 0.0 | 0.0 | 108 | 328.4 | 418.7 | 1.9 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 50.4 | 50.4 | 0.0 | 0.0 | 132 | 352.4 | 444.2 | 16.6 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 50.4 | 50.4 | 0.0 | 0.0 | 132 | 352.4 | 444.2 | 16.6 | 0.0 |
| LOS by Move: | A | A | A | D | D | A | A | F | F | F | B | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 13 | 13 | 0 | 0 | 19 | 25 | 37 | 3 | 0 |





Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #16 Fremont / Folsom / I-80 WB Off-Ramp

| | | | |
|---|---|---|---|
| Cycle (sec): | 75 | Critical Vol./Cap.(X): | 1.072 |
| Loss Time (sec): | 16 | Average Delay (sec/veh): | 312.8 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Fremont / I-80 WB Off-Ramp | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 19 | 19 | 19 | 19 | 0 | 21 | 21 | 21 | 0 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 32 | 32 | 15 | 290 | 103 | 0 | 216 | 510 | 183 | 0 | 649 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 32 | 32 | 15 | 290 | 103 | 0 | 216 | 510 | 183 | 0 | 649 | 0 |
| Added Vol: | 0 | 3 | 0 | 0 | 0 | 0 | 187 | 3 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 32 | 35 | 15 | 290 | 103 | 0 | 403 | 513 | 183 | 0 | 649 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 33 | 36 | 15 | 296 | 105 | 0 | 411 | 523 | 187 | 0 | 662 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 33 | 36 | 15 | 296 | 105 | 0 | 411 | 523 | 187 | 0 | 662 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 33 | 36 | 15 | 296 | 105 | 0 | 411 | 523 | 187 | 0 | 662 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.80 | 0.80 | 0.80 | 0.86 | 0.90 | 1.00 | 0.47 | 0.47 | 0.47 | 0.95 | 0.86 | 0.95 |
| Lanes: | 0.78 | 0.85 | 0.37 | 1.00 | 1.00 | 0.00 | 0.73 | 0.94 | 0.33 | 0.00 | 2.00 | 0.00 |
| Final Sat.: | 1186 | 1297 | 556 | 1625 | 1710 | 0 | 649 | 826 | 295 | 0 | 3249 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.03 | 0.03 | 0.03 | 0.18 | 0.06 | 0.00 | 0.63 | 0.63 | 0.63 | 0.00 | 0.20 | 0.00 |
| Crit Moves: | | **** | | **** | | | | **** | | | | |
| Green/Cycle: | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.28 | 0.28 | 0.28 | 0.00 | 0.28 | 0.00 |
| Volume/Cap: | 0.11 | 0.11 | 0.11 | 0.72 | 0.24 | 0.00 | 2.26 | 2.26 | 2.26 | 0.00 | 0.73 | 0.00 |
| Uniform Del: | 21.5 | 21.5 | 21.5 | 25.6 | 22.3 | 0.0 | 27.0 | 27.0 | 27.0 | 0.0 | 24.4 | 0.0 |
| IncremntDel: | 0.3 | 0.3 | 0.3 | 10.3 | 1.3 | 0.0 | 575.0 | 575 | 575.0 | 0.0 | 5.1 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| Delay/Veh: | 21.8 | 21.8 | 21.8 | 35.9 | 23.6 | 0.0 | 602.0 | 602 | 602.0 | 0.0 | 29.5 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 21.8 | 21.8 | 21.8 | 35.9 | 23.6 | 0.0 | 602.0 | 602 | 602.0 | 0.0 | 29.5 | 0.0 |
| LOS by Move: | C | C | C | D | C | A | F | F | F | A | C | A |
| HCM2kAvgQ: | 1 | 1 | 1 | 8 | 2 | 0 | 54 | 54 | 54 | 0 | 8 | 0 |

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #17 Beale / Folsom

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.726 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 221.7 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Beale | | | | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | | | | |
| Movement: | L | - T | - R | L | - T | - R | L | - T | - R | L | - T | - R | | | |
| Control: | Permitted | | | Permitted | | | Split Phase | | | Split Phase | | | | | |
| Rights: | Include | | | Include | | | Include | | | Include | | | | | |
| Min. Green: | 0 | 0 | 23 | 23 | 23 | 0 | 0 | 29 | 29 | 0 | 0 | 0 | | | |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | |
| Lanes: | 1 | 0 0 | 0 1 | 0 | 1 0 | 1 0 | 0 | 0 1 | 1 0 | 0 | 1 | 1 0 | 0 | | |
| Volume Module: | | | | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 98 | 170 | 578 | 453 | 0 | 808 | 74 | 74 | 196 | 0 | | | |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Initial Bse: | 0 | 0 | 98 | 170 | 578 | 453 | 0 | 808 | 74 | 74 | 196 | 0 | | | |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | | | |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| Initial Fut: | 0 | 0 | 98 | 170 | 578 | 453 | 0 | 811 | 74 | 74 | 196 | 0 | | | |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | | | |
| PHF Volume: | 0 | 0 | 100 | 173 | 590 | 462 | 0 | 828 | 76 | 76 | 200 | 0 | | | |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| Reduced Vol: | 0 | 0 | 100 | 173 | 590 | 462 | 0 | 828 | 76 | 76 | 200 | 0 | | | |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| FinalVolume: | 0 | 0 | 100 | 173 | 590 | 462 | 0 | 828 | 76 | 76 | 200 | 0 | | | |
| Saturation Flow Module: | | | | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | | | |
| Adjustment: | 1.00 | 1.00 | 0.75 | 0.71 | 0.71 | 0.71 | 1.00 | 0.25 | 0.25 | 0.84 | 0.84 | 1.00 | | | |
| Lanes: | 1.00 | 0.00 | 1.00 | 0.28 | 0.97 | 0.75 | 0.00 | 1.83 | 0.17 | 0.55 | 1.45 | 0.00 | | | |
| Final Sat.: | 1900 | 0 | 1424 | 384 | 1305 | 1023 | 0 | 864 | 79 | 878 | 2326 | 0 | | | |
| Capacity Analysis Module: | | | | | | | | | | | | | | | |
| Vol/Sat: | [illegible] | | | 0.45 | 0.45 | 0.45 | 0.00 | 0.96 | 0.96 | 0.09 | 0.09 | 0.00 | | | |
| Crit Moves: | | | | | **** | | | | **** | | **** | | | | |
| Green/Cycle: | [illegible] | | | 0.38 | 0.38 | 0.38 | 0.00 | 0.48 | 0.48 | 0.00 | 0.00 | 0.00 | | | |
| Volume/Cap: | [illegible] | | | 1.19 | 1.19 | 1.19 | 0.00 | 1.98 | 1.98 | xxxx | xxxx | 0.00 | | | |
| Uniform Del: | [illegible] | | | 18.5 | 18.5 | 18.5 | 0.0 | 15.5 | 15.5 | 0.0 | 0.0 | 0.0 | | | |
| IncremntDel: | [illegible] | | | 90.7 | 90.7 | 90.7 | 0.0 | 450 | 449.6 | 0.0 | 0.0 | 0.0 | | | |
| InitQueuDel: | [illegible] | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| Delay Adj: | [illegible] | | | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | | | |
| Delay/Veh: | [illegible] | | | 109.2 | 109.2 | 109.2 | 0.0 | 465 | 465.1 | 0.0 | 0.0 | 0.0 | | | |
| User DelAdj: | [illegible] | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| AdjDel/Veh: | [illegible] | | | 109.2 | 109.2 | 109.2 | 0.0 | 465 | 465.1 | 0.0 | 0.0 | 0.0 | | | |
| LOS by Move: | A | A | A | F | F | F | A | F | F | A | A | A | | | |
| HCM2kAvgQ: | [illegible] | | | 28 | 28 | 28 | 0 | 39 | 39 | 2 | 2 | 0 | | | |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #18 Main / Folsom

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.756 |
| Loss Time (sec): | 10 | Average Delay (sec/veh): | 202.2 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Main | | | | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | | | | |
| Movement: | L | - T | - R | L | - T | - R | L | - T | - R | L | - T | - R | | | |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | | | | |
| Rights: | Include | | | Include | | | Include | | | Include | | | | | |
| Min. Green: | 0 | 19 | 19 | 0 | 0 | 0 | 31 | 31 | 31 | 31 | 0 | 31 | | | |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | |
| Lanes: | 0 | 1 0 | 0 1 | 0 | 0 1! | 0 0 | 0 | 1 0 | 1 0 | 0 | 1 | 0 1 | 0 | | |
| Volume Module: | | | | | | | | | | | | | | | |
| Base Vol: | 196 | 172 | 31 | 74 | 271 | 149 | 45 | 979 | 343 | 5 | 0 | 217 | | | |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Initial Bse: | 196 | 172 | 31 | 74 | 271 | 149 | 45 | 979 | 343 | 5 | 0 | 217 | | | |
| Added Vol: | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | | | |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| Initial Fut: | 196 | 173 | 31 | 74 | 271 | 149 | 46 | 980 | 343 | 5 | 0 | 217 | | | |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | | | |
| PHF Volume: | 200 | 177 | 32 | 76 | 277 | 152 | 47 | 1000 | 350 | 5 | 0 | 221 | | | |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| Reduced Vol: | 200 | 177 | 32 | 76 | 277 | 152 | 47 | 1000 | 350 | 5 | 0 | 221 | | | |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| FinalVolume: | 200 | 177 | 32 | 76 | 277 | 152 | 47 | 1000 | 350 | 5 | 0 | 221 | | | |
| Saturation Flow Module: | | | | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | | | |
| Adjustment: | 0.86 | 0.73 | 0.75 | 0.86 | 0.86 | 0.86 | 0.67 | 0.41 | 0.37 | 0.66 | 0.95 | 0.66 | | | |
| Lanes: | 0.49 | 0.51 | 1.00 | 0.15 | 0.55 | 0.30 | 0.04 | 1.42 | 0.54 | 1.00 | 0.00 | 1.00 | | | |
| Final Sat.: | 801 | 707 | 1424 | 244 | 893 | 491 | 52 | 1107 | 387 | 1262 | 0 | 1262 | | | |
| Capacity Analysis Module: | | | | | | | | | | | | | | | |
| Vol/Sat: | 0.25 | 0.25 | 0.02 | 0.31 | 0.31 | 0.31 | 0.90 | 0.90 | 0.90 | 0.00 | 0.00 | 0.18 | | | |
| Crit Moves: | | **** | | | **** | | | **** | | | | | | | |
| Green/Cycle: | 0.32 | 0.32 | 0.32 | 0.00 | 0.00 | 0.00 | 0.52 | 0.52 | 0.52 | 0.52 | 0.00 | 0.52 | | | |
| Volume/Cap: | 0.79 | 0.79 | 0.07 | xxxx | xxxx | xxxx | 1.75 | 1.75 | 1.75 | 0.01 | 0.00 | 0.34 | | | |
| Uniform Del: | 18.7 | 18.7 | 14.3 | 0.0 | 0.0 | 0.0 | 14.5 | 14.5 | 14.5 | 7.0 | 0.0 | 8.5 | | | |
| IncremntDel: | 12.4 | 12.4 | 0.3 | 0.0 | 0.0 | 0.0 | 342.2 | 342 | 342.2 | 0.0 | 0.0 | 1.4 | | | |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | | | |
| Delay/Veh: | 31.1 | 31.1 | 14.6 | 0.0 | 0.0 | 0.0 | 356.7 | 357 | 356.7 | 7.0 | 0.0 | 9.9 | | | |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| AdjDel/Veh: | 31.1 | 31.1 | 14.6 | 0.0 | 0.0 | 0.0 | 356.7 | 357 | 356.7 | 7.0 | 0.0 | 9.9 | | | |
| LOS by Move: | C | C | B | A | A | A | F | F | F | A | A | A | | | |
| HCM2kAvgQ: | 8 | 7 | 0 | 8 | 8 | 8 | 88 | 54 | 50 | 0 | 0 | 3 | | | |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #19 Spear / Folsom

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 2.490 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 553.5 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Spear | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 23 | 23 | 23 | 0 | 29 | 29 | 29 | 29 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! 0 | 0 | 0 | 1! 0 | 0 | 1 | 0 1 | 0 | 1 | 0 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 23 | 23 | 137 | 164 | 328 | 82 | 292 | 676 | 55 | 19 | 107 | 65 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 23 | 23 | 137 | 164 | 328 | 82 | 292 | 676 | 55 | 19 | 107 | 65 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 23 | 23 | 137 | 164 | 328 | 82 | 292 | 677 | 55 | 19 | 107 | 65 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 23 | 23 | 140 | 167 | 335 | 84 | 298 | 691 | 56 | 19 | 109 | 66 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 23 | 23 | 140 | 167 | 335 | 84 | 298 | 691 | 56 | 19 | 109 | 66 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 23 | 23 | 140 | 167 | 335 | 84 | 298 | 691 | 56 | 19 | 109 | 66 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.75 | 0.75 | 0.75 | 0.29 | 0.29 | 0.29 | 0.66 | 0.20 | 0.20 | 0.68 | 0.68 | 0.68 |
| Lanes: | 0.12 | 0.13 | 0.75 | 0.29 | 0.57 | 0.14 | 0.21 | 1.66 | 0.13 | 0.20 | 1.12 | 0.68 |
| Final Sat.: | 179 | 179 | 1068 | 160 | 320 | 80 | 268 | 621 | 50 | 259 | 1457 | 885 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.13 | 0.13 | 0.13 | 1.05 | 1.05 | 1.05 | 1.11 | 1.11 | 1.11 | 0.07 | 0.07 | 0.07 |
| Crit Moves: | | | | | **** | | | **** | | | | |
| Green/Cycle: | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 | 0.38 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 |
| Volume/Cap: | 0.34 | 0.34 | 0.34 | 2.73 | 2.73 | 2.73 | 2.30 | 2.30 | 2.30 | 0.15 | 0.15 | 0.15 |
| Uniform Del: | 13.1 | 13.1 | 13.1 | 18.5 | 18.5 | 18.5 | 15.5 | 15.5 | 15.5 | 8.7 | 8.7 | 8.7 |
| IncremntDel: | 1.7 | 1.7 | 1.7 | 791.7 | 792 | 791.7 | 591.9 | 592 | 591.9 | 0.3 | 0.3 | 0.3 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 14.8 | 14.8 | 14.8 | 810.2 | 810 | 810.2 | 607.4 | 607 | 607.4 | 8.9 | 8.9 | 8.9 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 14.8 | 14.8 | 14.8 | 810.2 | 810 | 810.2 | 607.4 | 607 | 607.4 | 8.9 | 8.9 | 8.9 |
| LOS by Move: | B | B | B | F | F | F | F | F | F | A | A | A |
| HCM2kAvgQ: | 3 | 3 | 3 | 58 | 58 | 58 | 130 | 40 | 40 | 1 | 1 | 1 |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #20 The Embarcadero / Folsom

| | | | |
|---|---|---|---|
| Cycle (sec): | 90 | Critical Vol./Cap.(X): | 1.191 |
| Loss Time (sec): | 10 | Average Delay (sec/veh): | 144.6 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | The Embarcadero | | | | | | Folsom | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Protected | | | Protected | | | Split Phase | | | Split Phase | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 12 | 49 | 0 | 0 | 32 | 32 | 31 | 0 | 31 | 0 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 1 | 0 | 2 0 0 | 0 | 0 | 1 1 0 | 1 | 0 | 0 0 1 | 0 | 0 | 0 0 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 249 | 2051 | 0 | 0 | 1596 | 32 | 541 | 0 | 377 | 0 | 0 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 249 | 2051 | 0 | 0 | 1596 | 32 | 541 | 0 | 377 | 0 | 0 | 0 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 249 | 2051 | 0 | 0 | 1596 | 32 | 541 | 0 | 378 | 0 | 0 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 254 | 2093 | 0 | 0 | 1629 | 33 | 552 | 0 | 386 | 0 | 0 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 254 | 2093 | 0 | 0 | 1629 | 33 | 552 | 0 | 386 | 0 | 0 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 254 | 2093 | 0 | 0 | 1629 | 33 | 552 | 0 | 386 | 0 | 0 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.93 | 0.74 | 1.00 | 1.00 | 1.02 | 0.93 | 0.93 | 1.00 | 0.83 | 1.00 | 1.00 | 1.00 |
| Lanes: | 1.00 | 2.00 | 0.00 | 0.00 | 1.96 | 0.04 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Final Sat.: | 1769 | 2802 | 0 | 0 | 3796 | 76 | 1769 | 0 | 1583 | 0 | 0 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.14 | 0.75 | 0.00 | 0.00 | 0.43 | 0.43 | 0.31 | 0.00 | 0.24 | 0.00 | 0.00 | 0.00 |
| Crit Moves: | | **** | | | **** | | | **** | | | | |
| Green/Cycle: | 0.13 | 0.54 | 0.00 | 0.00 | 0.35 | 0.35 | 0.34 | 0.00 | 0.34 | 0.00 | 0.00 | 0.00 |
| Volume/Cap: | 1.10 | 1.38 | 0.00 | 0.00 | 1.23 | 1.23 | 0.92 | 0.00 | 0.72 | 0.00 | 0.00 | 0.00 |
| Uniform Del: | 39.2 | 20.7 | 0.0 | 0.0 | 29.3 | 29.3 | 28.5 | 0.0 | 25.9 | 0.0 | 0.0 | 0.0 |
| IncremntDel: | 90.3 | 177 | 0.0 | 0.0 | 108 | 108.3 | 21.2 | 0.0 | 8.0 | 0.0 | 0.0 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Delay/Veh: | 129.5 | 197 | 0.0 | 0.0 | 138 | 137.6 | 49.7 | 0.0 | 33.9 | 0.0 | 0.0 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 129.5 | 197 | 0.0 | 0.0 | 138 | 137.6 | 49.7 | 0.0 | 33.9 | 0.0 | 0.0 | 0.0 |
| LOS by Move: | F | F | A | A | F | F | D | A | C | A | A | A |
| HCM2kAvgQ: | 10 | 66 | 0 | 0 | 42 | 39 | 14 | 0 | 9 | 0 | 0 | 0 |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #21 Second / Harrison

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.557 |
| Loss Time (sec): | 10 | Average Delay (sec/veh): | 186.7 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Second | | | | | | Harrison | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 29 | 29 | 29 | 29 | 29 | 29 | 21 | 21 | 21 | 21 | 21 | 21 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 1 | 1 0 | 2 | 0 | 1 0 | 1 0 | 1 | 0 1 | 0 | 1 | 0 1 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 74 | 462 | 870 | 223 | 566 | 490 | 20 | 243 | 27 | 134 | 727 | 72 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 74 | 462 | 870 | 223 | 566 | 490 | 20 | 243 | 27 | 134 | 727 | 72 |
| Added Vol: | 0 | 70 | 0 | 0 | 22 | 33 | 0 | 1 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 74 | 532 | 870 | 223 | 588 | 523 | 20 | 244 | 27 | 134 | 727 | 72 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 76 | 543 | 888 | 228 | 600 | 534 | 20 | 249 | 28 | 137 | 742 | 73 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 76 | 543 | 888 | 228 | 600 | 534 | 20 | 249 | 28 | 137 | 742 | 73 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 76 | 543 | 888 | 228 | 600 | 534 | 20 | 249 | 28 | 137 | 742 | 73 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.52 | 0.52 | 0.40 | 0.16 | 0.54 | 0.54 | 0.73 | 0.18 | 0.73 | 0.40 | 0.65 | 0.65 |
| Lanes: | 0.24 | 1.76 | 2.00 | 0.81 | 0.63 | 0.56 | 0.04 | 1.91 | 0.05 | 1.00 | 1.82 | 0.18 |
| Final Sat.: | 242 | 1739 | 1504 | 247 | 650 | 579 | 54 | 663 | 73 | 757 | 2260 | 224 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.31 | 0.31 | 0.59 | 0.92 | 0.92 | 0.92 | 0.38 | 0.38 | 0.38 | 0.18 | 0.33 | 0.33 |
| Crit Moves: | | | | | **** | | | **** | | | | |
| Green/Cycle: | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 |
| Volume/Cap: | 0.65 | 0.65 | 1.22 | 1.91 | 1.91 | 1.91 | 1.07 | 1.07 | 1.07 | 0.52 | 0.94 | 0.94 |
| Uniform Del: | 11.6 | 11.6 | 15.5 | 15.5 | 15.5 | 15.5 | 19.5 | 19.5 | 19.5 | 15.5 | 18.9 | 18.9 |
| IncremntDel: | 3.4 | 3.4 | 111.7 | 414.0 | 414 | 414.0 | 74.6 | 74.6 | 74.6 | 7.0 | 18.7 | 18.7 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 15.0 | 15.0 | 127.2 | 429.5 | 429 | 429.5 | 94.1 | 94.1 | 94.1 | 22.5 | 37.6 | 37.6 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 15.0 | 15.0 | 127.2 | 429.5 | 429 | 429.5 | 94.1 | 94.1 | 94.1 | 22.5 | 37.6 | 37.6 |
| LOS by Move: | B | B | F | F | F | F | F | F | F | C | D | D |
| HCM2kAvgQ: | 7 | 7 | 41 | 79 | 79 | 79 | 20 | 7 | 20 | 3 | 13 | 13 |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #22 First / Harrison / I-80 EB On-Ramp

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.513 |
| Loss Time (sec): | 8 | Average Delay (sec/veh): | 161.9 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | First | | | | | | Harrison | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permit+Prot | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 31 | 0 | 31 | 31 | 31 | 31 | 0 | 6 | 6 | 11 | 21 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! 0 | 0 | 1 | 0 2 | 0 1 | 0 | 1 0 | 1 | 1 | 1 0 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 1 | 0 | 1 | 21 | 1488 | 267 | 0 | 66 | 11 | 955 | 654 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 1 | 0 | 1 | 21 | 1488 | 267 | 0 | 66 | 11 | 955 | 654 | 0 |
| Added Vol: | 0 | 0 | 0 | 2 | 30 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 1 | 0 | 1 | 23 | 1518 | 267 | 0 | 67 | 11 | 955 | 654 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 1 | 0 | 1 | 23 | 1549 | 272 | 0 | 68 | 11 | 974 | 667 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 1 | 0 | 1 | 23 | 1549 | 272 | 0 | 68 | 11 | 974 | 667 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 1 | 0 | 1 | 23 | 1549 | 272 | 0 | 68 | 11 | 974 | 667 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.72 | 1.00 | 0.72 | 0.15 | 0.52 | 0.36 | 1.00 | 0.80 | 0.16 | 0.70 | 0.78 | 1.00 |
| Lanes: | 0.50 | 0.00 | 0.50 | 1.00 | 2.00 | 1.00 | 0.00 | 1.10 | 0.90 | 1.82 | 1.18 | 0.00 |
| Final Sat.: | 681 | 0 | 681 | 287 | 1990 | 685 | 0 | 1663 | 273 | 2422 | 1758 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.08 | 0.78 | 0.40 | 0.00 | 0.04 | 0.04 | 0.40 | 0.38 | 0.00 |
| Crit Moves: | | | | | **** | | | | | **** | | |
| Green/Cycle: | 0.52 | 0.00 | 0.52 | 0.52 | 0.52 | 0.52 | 0.10 | 0.10 | 0.10 | 0.35 | 0.35 | 0.00 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.16 | 1.50 | 0.76 | 0.00 | 0.41 | 0.41 | 1.27 | 1.08 | 0.00 |
| Uniform Del: | 6.9 | 0.0 | 6.9 | 7.5 | 14.4 | 11.5 | 0.0 | 25.3 | 25.3 | 22.6 | 19.5 | 0.0 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 2.2 | 229 | 14.5 | 0.0 | 6.3 | 6.3 | 126.6 | 49.8 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Delay/Veh: | 6.9 | 0.0 | 6.9 | 9.8 | 243 | 25.9 | 0.0 | 31.7 | 31.7 | 149.2 | 69.3 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 6.9 | 0.0 | 6.9 | 9.8 | 243 | 25.9 | 0.0 | 31.7 | 31.7 | 149.2 | 69.3 | 0.0 |
| LOS by Move: | A | A | A | A | F | C | A | C | C | F | E | A |
| HCM2kAvgQ: | 0 | 0 | 0 | 0 | 50 | 6 | 0 | 2 | 1 | 24 | 16 | 0 |

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Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #23 Fremont / Harrison / I-80 WB Off-Ramp

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 0.911 |
| Loss Time (sec): | 10 | Average Delay (sec/veh): | 80.0 |
| Optimal Cycle: | 83 | Level Of Service: | E |

| Street Name: | Fremont / I-80 WB Off-Ramp | | | | | | Harrison | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Split Phase | | | Split Phase | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 0 | 0 | 0 | 0 | 21 | 29 | 29 | 0 | 0 | 29 | 29 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 1 0 | 1 0 | 0 | 0 0 | 0 1 | 0 | 1 0 | 0 0 | 0 | 0 2 | 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 0 | 0 | 0 | 0 | 279 | 5 | 89 | 0 | 0 | 1317 | 74 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 0 | 0 | 0 | 0 | 279 | 5 | 89 | 0 | 0 | 1317 | 74 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 0 | 0 | 0 | 0 | 279 | 8 | 89 | 0 | 0 | 1317 | 74 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 0 | 0 | 0 | 0 | 285 | 8 | 91 | 0 | 0 | 1344 | 76 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 0 | 0 | 0 | 0 | 285 | 8 | 91 | 0 | 0 | 1344 | 76 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 0 | 0 | 0 | 0 | 285 | 8 | 91 | 0 | 0 | 1344 | 76 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.95 | 0.95 | 0.95 | 1.00 | 1.00 | 0.76 | 0.80 | 0.80 | 1.00 | 1.00 | 0.43 | 0.79 |
| Lanes: | 0.00 | 0.00 | 2.00 | 0.00 | 0.00 | 1.00 | 0.08 | 0.92 | 0.00 | 0.00 | 2.91 | 0.09 |
| Final Sat.: | 0 | 0 | 3610 | 0 | 0 | 1435 | 125 | 1388 | 0 | 0 | 2397 | 135 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.07 | 0.07 | 0.00 | 0.00 | 0.56 | 0.56 |
| Crit Moves: | | | | | | **** | | | | | **** | |
| Green/Cycle: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 | 0.48 | 0.48 | 0.00 | 0.00 | 0.48 | 0.48 |
| Volume/Cap: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.57 | 0.14 | 0.14 | 0.00 | 0.00 | 1.16 | 1.16 |
| Uniform Del: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.8 | 8.6 | 8.6 | 0.0 | 0.0 | 15.5 | 15.5 |
| IncremntDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.6 | 0.4 | 0.4 | 0.0 | 0.0 | 81.4 | 81.4 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Delay/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.4 | 9.0 | 9.0 | 0.0 | 0.0 | 96.9 | 96.9 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.4 | 9.0 | 9.0 | 0.0 | 0.0 | 96.9 | 96.9 |
| LOS by Move: | A | A | A | A | A | C | A | A | A | A | F | F |
| HCM2kAvgQ: | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 1 | 0 | 0 | 18 | 32 |





Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #24 Main / Harrison

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.195 |
| Loss Time (sec): | 9 | Average Delay (sec/veh): | 73.6 |
| Optimal Cycle: | 180 | Level Of Service: | E |

| Street Name: | Main | | | | | | Harrison | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 25 | 25 | 25 | 25 | 25 | 25 | 26 | 26 | 26 | 26 | 26 | 26 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 1 | 0 0 | 1 0 | 0 | 1 0 | 0 1 | 0 | 0 1! | 0 0 | 0 | 1 1 | 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 239 | 316 | 22 | 5 | 242 | 205 | 12 | 44 | 28 | 7 | 846 | 41 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 239 | 316 | 22 | 5 | 242 | 205 | 12 | 44 | 28 | 7 | 846 | 41 |
| Added Vol: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 239 | 317 | 22 | 5 | 242 | 205 | 12 | 44 | 28 | 7 | 846 | 41 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 244 | 323 | 22 | 5 | 247 | 209 | 12 | 45 | 29 | 7 | 863 | 42 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 244 | 323 | 22 | 5 | 247 | 209 | 12 | 45 | 29 | 7 | 863 | 42 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 244 | 323 | 22 | 5 | 247 | 209 | 12 | 45 | 29 | 7 | 863 | 42 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.25 | 0.87 | 0.87 | 0.88 | 0.88 | 0.31 | 0.75 | 0.75 | 0.75 | 0.73 | 0.31 | 0.73 |
| Lanes: | 1.00 | 0.94 | 0.06 | 0.02 | 0.98 | 1.00 | 0.14 | 0.53 | 0.33 | 0.01 | 2.93 | 0.06 |
| Final Sat.: | 475 | 1551 | 108 | 34 | 1632 | 598 | 204 | 747 | 475 | 14 | 1719 | 83 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.51 | 0.21 | 0.21 | 0.15 | 0.15 | 0.35 | 0.06 | 0.06 | 0.06 | 0.50 | 0.50 | 0.50 |
| Crit Moves: | **** | | | | | | | | | | **** | |
| Green/Cycle: | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 |
| Volume/Cap: | 1.23 | 0.50 | 0.50 | 0.36 | 0.36 | 0.84 | 0.14 | 0.14 | 0.14 | 1.16 | 1.16 | 1.16 |
| Uniform Del: | 17.5 | 12.9 | 12.9 | 12.0 | 12.0 | 15.7 | 10.2 | 10.2 | 10.2 | 17.0 | 17.0 | 17.0 |
| IncremntDel: | 140.3 | 2.6 | 2.6 | 1.5 | 1.5 | 27.3 | 0.5 | 0.5 | 0.5 | 85.6 | 85.6 | 85.6 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 157.8 | 15.5 | 15.5 | 13.5 | 13.5 | 43.0 | 10.7 | 10.7 | 10.7 | 102.6 | 103 | 102.6 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 157.8 | 15.5 | 15.5 | 13.5 | 13.5 | 43.0 | 10.7 | 10.7 | 10.7 | 102.6 | 103 | 102.6 |
| LOS by Move: | F | B | B | B | B | D | B | B | B | F | F | F |
| HCM2kAvgQ: | 13 | 5 | 5 | 3 | 3 | 3 | 1 | 1 | 1 | 26 | 11 | 26 |

Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #25 Spear / Harrison

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.203 |
| Loss Time (sec): | 10 | Average Delay (sec/veh): | 100.6 |
| Optimal Cycle: | 180 | Level Of Service: | F |

| Street Name: | Spear | | | | | | Harrison | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Permitted | | | Permitted | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 21 | 0 | 21 | 21 | 21 | 21 | 0 | 29 | 29 | 29 | 29 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1! 0 | 0 | 0 | 1 | 0 | 0 | 1 0 | 0 | 1 | 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 46 | 190 | 143 | 70 | 20 | 542 | 0 | 85 | 65 | 27 | 372 | 27 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 46 | 190 | 143 | 70 | 20 | 542 | 0 | 85 | 65 | 27 | 372 | 27 |
| Added Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 46 | 190 | 143 | 70 | 20 | 542 | 0 | 85 | 65 | 27 | 372 | 27 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 47 | 194 | 146 | 71 | 20 | 553 | 0 | 87 | 66 | 28 | 380 | 28 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 47 | 194 | 146 | 71 | 20 | 553 | 0 | 87 | 66 | 28 | 380 | 28 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 47 | 194 | 146 | 71 | 20 | 553 | 0 | 87 | 66 | 28 | 380 | 28 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 0.80 | 0.80 | 0.80 | 0.53 | 0.53 | 0.60 | 1.00 | 0.83 | 0.83 | 0.23 | 0.21 | 0.78 |
| Lanes: | 0.11 | 0.80 | 0.39 | 0.78 | 0.22 | 1.00 | 0.00 | 0.57 | 0.43 | 0.12 | 1.84 | 0.04 |
| Final Sat.: | 184 | 761 | 573 | 787 | 225 | 1140 | 0 | 895 | 684 | 53 | 733 | 53 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.25 | 0.25 | 0.25 | 0.09 | 0.09 | 0.49 | 0.00 | 0.10 | 0.10 | 0.52 | 0.52 | 0.52 |
| Crit Moves: | | | | | | **** | | | | | **** | |
| Green/Cycle: | 0.48 | 0.48 | 0.48 | 0.35 | 0.35 | 0.35 | 0.00 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 |
| Volume/Cap: | 0.53 | 0.53 | 0.53 | 0.26 | 0.26 | 1.39 | 0.00 | 0.20 | 0.20 | 1.07 | 1.07 | 1.07 |
| Uniform Del: | 17.1 | 17.1 | 17.1 | 13.9 | 13.9 | 19.5 | 0.0 | 8.9 | 8.9 | 15.5 | 15.5 | 15.5 |
| IncremntDel: | 1.5 | 1.5 | 1.5 | 1.2 | 1.2 | 167.9 | 0.0 | 0.6 | 0.6 | 64.8 | 64.8 | 64.8 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Delay/Veh: | 18.6 | 18.6 | 18.6 | 15.1 | 15.1 | 187.4 | 0.0 | 9.5 | 9.5 | 80.3 | 80.3 | 80.3 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 18.6 | 18.6 | 18.6 | 15.1 | 15.1 | 187.4 | 0.0 | 9.5 | 9.5 | 80.3 | 80.3 | 80.3 |
| LOS by Move: | C | C | C | B | B | F | A | A | A | F | F | F |
| HCM2kAvgQ: | 1 | 1 | 1 | 1 | 1 | 20 | 0 | 2 | 2 | 8 | 7 | 26 |





Level Of Service Computation Report
2000 HCM Operations Method (Future Volume Alternative)

Intersection #26 Second / Bryant

| | | | |
|---|---|---|---|
| Cycle (sec): | 60 | Critical Vol./Cap.(X): | 1.229 |
| Loss Time (sec): | 7 | Average Delay (sec/veh): | 77.9 |
| Optimal Cycle: | 180 | Level Of Service: | E |

| Street Name: | Second | | | | | | Bryant | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Approach: | North Bound | | | South Bound | | | East Bound | | | West Bound | | |
| Movement: | L | T | R | L | T | R | L | T | R | L | T | R |
| Control: | Permitted | | | Permitted | | | Split Phase | | | Split Phase | | |
| Rights: | Include | | | Include | | | Include | | | Include | | |
| Min. Green: | 0 | 26 | 26 | 26 | 26 | 0 | 27 | 27 | 27 | 0 | 0 | 0 |
| Y+R: | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lanes: | 0 | 0 | 1 1 | 1 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 2 1 0 |
| Volume Module: | | | | | | | | | | | | |
| Base Vol: | 0 | 651 | 151 | 9 | 650 | 0 | 778 | 787 | 37 | 0 | 0 | 0 |
| Growth Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Initial Bse: | 0 | 651 | 151 | 9 | 650 | 0 | 778 | 787 | 37 | 0 | 0 | 0 |
| Added Vol: | 0 | 32 | 0 | 0 | 22 | 0 | 38 | 0 | 0 | 0 | 0 | 0 |
| PasserByVol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initial Fut: | 0 | 683 | 151 | 9 | 672 | 0 | 816 | 787 | 37 | 0 | 0 | 0 |
| User Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| PHF Adj: | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| PHF Volume: | 0 | 697 | 154 | 9 | 686 | 0 | 833 | 803 | 38 | 0 | 0 | 0 |
| Reduct Vol: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced Vol: | 0 | 697 | 154 | 9 | 686 | 0 | 833 | 803 | 38 | 0 | 0 | 0 |
| PCE Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| MLF Adj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| FinalVolume: | 0 | 697 | 154 | 9 | 686 | 0 | 833 | 803 | 38 | 0 | 0 | 0 |
| Saturation Flow Module: | | | | | | | | | | | | |
| Sat/Lane: | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Adjustment: | 1.00 | 0.39 | 0.16 | 0.78 | 0.78 | 1.00 | 0.38 | 0.31 | 0.77 | 1.00 | 1.00 | 1.00 |
| Lanes: | 0.00 | 2.00 | 1.00 | 0.03 | 1.97 | 0.00 | 2.00 | 2.94 | 0.06 | 0.00 | 0.00 | 0.00 |
| Final Sat.: | 0 | 1493 | 299 | 39 | 2934 | 0 | 1462 | 1715 | 81 | 0 | 0 | 0 |
| Capacity Analysis Module: | | | | | | | | | | | | |
| Vol/Sat: | 0.00 | 0.47 | 0.52 | 0.23 | 0.23 | 0.00 | 0.57 | 0.47 | 0.47 | 0.00 | 0.00 | 0.00 |
| Crit Moves: | | | **** | | | | **** | | | | | |
| Green/Cycle: | 0.00 | 0.43 | 0.43 | 0.43 | 0.43 | 0.00 | 0.45 | 0.45 | 0.45 | 0.00 | 0.00 | 0.00 |
| Volume/Cap: | 0.00 | 1.08 | 1.19 | 0.54 | 0.54 | 0.00 | 1.27 | 1.04 | 1.04 | 0.00 | 0.00 | 0.00 |
| Uniform Del: | 0.0 | 17.0 | 17.0 | 12.6 | 12.6 | 0.0 | 16.5 | 16.5 | 16.5 | 0.0 | 0.0 | 0.0 |
| IncremntDel: | 0.0 | 55.0 | 99.5 | 1.6 | 1.6 | 0.0 | 131.5 | 42.6 | 42.6 | 0.0 | 0.0 | 0.0 |
| InitQueuDel: | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delay Adj: | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Delay/Veh: | 0.0 | 72.0 | 116.5 | 14.2 | 14.2 | 0.0 | 148.0 | 59.1 | 59.1 | 0.0 | 0.0 | 0.0 |
| User DelAdj: | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| AdjDel/Veh: | 0.0 | 72.0 | 116.5 | 14.2 | 14.2 | 0.0 | 148.0 | 59.1 | 59.1 | 0.0 | 0.0 | 0.0 |
| LOS by Move: | A | E | F | B | B | A | F | E | E | A | A | A |
| HCM2kAvgQ: | 0 | 15 | 9 | 6 | 6 | 0 | 22 | 12 | 24 | 0 | 0 | 0 |

# Non-Motorized Mode Analysis

Table 1A - PM 2030 No Project - Crosswalk Level of Service Calculation

| Intersection | Crosswalk | Pedestrian Green Time | Pedestrians per 15 minutes | | $N_{TV}$ | Length (Ld) | Width (Wd) |
|---|---|---|---|---|---|---|---|
| | | | Inbound ($V_{di}$) | Outbound ($V_{do}$) | | | |
| | | | East/North | West/South | | | |
| 1st & Howard | $N_{crosswalk}$ | 18.5 | 110 | 95 | 0.0 | 37 | 12 |
| | $E_{crosswalk}$ | 27 | 111 | 88 | 0.0 | 38 | 9 |
| | $S_{crosswalk}$ | 18.5 | 92 | 85 | 0.0 | 48 | 11.5 |
| | $W_{crosswalk}$ | 27 | 89 | 88 | 18.2 | 37 | 9.5 |
| Fremont & Howard | $N_{crosswalk}$ | 20 | 93 | 77 | 2.7 | 47 | 11 |
| | $E_{crosswalk}$ | 33 | 144 | 89 | 5.7 | 37 | 10 |
| | $S_{crosswalk}$ | 20 | 109 | 72 | 0.0 | 50 | 11 |
| | $W_{crosswalk}$ | 33 | 82 | 86 | 0.0 | 45 | 9 |
| Beale & Folsom | $N_{crosswalk}$ | 30 | 32 | 26 | 0.0 | 43 | 11.5 |
| | $E_{crosswalk}$ | 27 | 21 | 37 | 1.6 | 48 | 9 |
| | $S_{crosswalk}$ | 30 | 30 | 25 | 1.2 | 38 | 9 |
| | $W_{crosswalk}$ | 27 | 19 | 22 | 7.6 | 49 | 9 |
| Fremont & Mission | $N_{crosswalk}$ | 19 | 239 | 255 | 1.8 | 48 | 13.5 |
| | $E_{crosswalk}$ | 25 | 228 | 286 | 4.2 | 38.5 | 14 |
| | $S_{crosswalk}$ | 19 | 281 | 202 | 0.0 | 48 | 13 |
| | $W_{crosswalk}$ | 25 | 260 | 398 | 0.0 | 46.5 | 14 |
| 1st & Mission | $N_{crosswalk}$ | 26 | 233 | 145 | 0.0 | 41 | 14.5 |
| | $E_{crosswalk}$ | 23 | 256 | 315 | 0.0 | 44.5 | 14.5 |
| | $S_{crosswalk}$ | 21 | 264 | 242 | 4.6 | 42 | 16.5 |
| | $W_{crosswalk}$ | 21 | 229 | 232 | 6.5 | 44.5 | 15 |

Table 1B - PM 2030 No Project - Crosswalk Level of Service Calculation

| Intersection | Crosswalk | $TS_E$ | Pedestrians per Cycle | | N | t | T | M | LOS |
|---|---|---|---|---|---|---|---|---|---|
| | | | Inbound ($V_{di}$) | Outbound ($V_{do}$) | | | | | |
| 1st & Howard | $N_{crosswalk}$ | 5867 | 7 | 6 | 5 | 15 | 204 | 29 | C |
| | $E_{crosswalk}$ | 7377 | 7 | 6 | 4 | 15 | 202 | 36 | C |
| | $S_{crosswalk}$ | 6427 | 6 | 6 | 4 | 18 | 211 | 30 | C |
| | $W_{crosswalk}$ | 710 | 6 | 6 | 4 | 15 | 176 | 4 | F |
| Fremont & Howard | $N_{crosswalk}$ | 5703 | 6 | 5 | 4 | 18 | 199 | 29 | C |
| | $E_{crosswalk}$ | 7994 | 10 | 6 | 4 | 15 | 230 | 35 | C |
| | $S_{crosswalk}$ | 7071 | 7 | 5 | 4 | 18 | 222 | 32 | C |
| | $W_{crosswalk}$ | 10761 | 5 | 6 | 4 | 17 | 192 | 56 | B |
| Beale & Folsom | $N_{crosswalk}$ | 11797 | 2 | 2 | 1 | 16 | 61 | 194 | A |
| | $E_{crosswalk}$ | 8114 | 1 | 2 | 2 | 17 | 67 | 121 | A |
| | $S_{crosswalk}$ | 7959 | 2 | 2 | 1 | 14 | 53 | 151 | A |
| | $W_{crosswalk}$ | 6102 | 1 | 1 | 1 | 18 | 48 | 126 | A |
| Fremont & Mission | $N_{crosswalk}$ | 6924 | 16 | 17 | 13 | 20 | 646 | 11 | E |
| | $E_{crosswalk}$ | 8140 | 15 | 19 | 14 | 17 | 578 | 14 | E |
| | $S_{crosswalk}$ | 7577 | 19 | 13 | 11 | 19 | 616 | 12 | E |
| | $W_{crosswalk}$ | 11951 | 17 | 27 | 19 | 20 | 886 | 13 | E |
| 1st & Mission | $N_{crosswalk}$ | 11975 | 16 | 10 | 7 | 16 | 408 | 29 | C |
| | $E_{crosswalk}$ | 10739 | 17 | 21 | 16 | 19 | 717 | 15 | E |
| | $S_{crosswalk}$ | 7381 | 18 | 16 | 12 | 17 | 580 | 13 | E |
| | $W_{crosswalk}$ | 5874 | 15 | 15 | 12 | 18 | 555 | 11 | F |

Table 2A - PM 2030 Project - Crosswalk Level of Service Calculation

| Intersection | Crosswalk | Pedestrian Green Time | Pedestrians per 15 minutes | | $N_{TV}$ | Length (Ld) | Width (Wd) |
|---|---|---|---|---|---|---|---|
| | | | Inbound ($V_{di}$) | Outbound ($V_{do}$) | | | |
| | | | East/North | West/South | | | |
| 1st & Howard | $N_{crosswalk}$ | 18.5 | 145 | 111 | 0.0 | 37 | 12 |
| | $E_{crosswalk}$ | 27 | 148 | 109 | 0.0 | 38 | 9 |
| | $S_{crosswalk}$ | 18.5 | 123 | 99 | 0.0 | 48 | 11.5 |
| | $W_{crosswalk}$ | 27 | 117 | 106 | 18.2 | 37 | 9.5 |
| Fremont & Howard | $N_{crosswalk}$ | 20 | 108 | 108 | 2.7 | 47 | 11 |
| | $E_{crosswalk}$ | 33 | 170 | 107 | 5.7 | 37 | 10 |
| | $S_{crosswalk}$ | 20 | 124 | 103 | 0.0 | 50 | 11 |
| | $W_{crosswalk}$ | 33 | 120 | 108 | 0.0 | 45 | 9 |
| Beale & Folsom | $N_{crosswalk}$ | 30 | 34 | 28 | 0.0 | 43 | 11.5 |
| | $E_{crosswalk}$ | 27 | 23 | 39 | 1.6 | 48 | 9 |
| | $S_{crosswalk}$ | 30 | 32 | 27 | 1.2 | 38 | 9 |
| | $W_{crosswalk}$ | 27 | 22 | 24 | 7.6 | 49 | 9 |
| Fremont & Mission | $N_{crosswalk}$ | 19 | 275 | 322 | 1.8 | 48 | 13.5 |
| | $E_{crosswalk}$ | 25 | 266 | 357 | 4.2 | 38.5 | 14 |
| | $S_{crosswalk}$ | 19 | 324 | 282 | 0.0 | 48 | 13 |
| | $W_{crosswalk}$ | 25 | 303 | 469 | 0.0 | 46.5 | 14 |
| 1st & Mission | $N_{crosswalk}$ | 26 | 280 | 169 | 0.0 | 41 | 14.5 |
| | $E_{crosswalk}$ | 23 | 285 | 359 | 0.0 | 44.5 | 14.5 |
| | $S_{crosswalk}$ | 21 | 316 | 269 | 4.6 | 42 | 16.5 |
| | $W_{crosswalk}$ | 21 | 257 | 273 | 6.5 | 44.5 | 15 |

Table 2B - PM 2030 Project - Crosswalk Level of Service Calculation

| Intersection | Crosswalk | $TS_E$ | Pedestrians per Cycle | | N | t | T | M | LOS |
|---|---|---|---|---|---|---|---|---|---|
| | | | Inbound ($V_{di}$) | Outbound ($V_{do}$) | | | | | |
| 1st & Howard | $N_{crosswalk}$ | 5867 | 10 | 7 | 6 | 18 | 258 | 23 | D |
| | $E_{crosswalk}$ | 7377 | 10 | 7 | 5 | 18 | 267 | 23 | C |
| | $S_{crosswalk}$ | 6427 | 12 | 7 | 5 | 18 | 268 | 24 | D |
| | $W_{crosswalk}$ | 710 | 8 | 7 | 5 | 18 | 225 | 3 | E |
| Fremont & Howard | $N_{crosswalk}$ | 5703 | 7 | 7 | 6 | 18 | 259 | 22 | D |
| | $E_{crosswalk}$ | 7959 | 11 | 7 | 5 | 18 | 276 | 24 | C |
| | $S_{crosswalk}$ | 7071 | 12 | 7 | 5 | 18 | 284 | 25 | C |
| | $W_{crosswalk}$ | 10761 | 12 | 7 | 1 | 17 | 284 | 11 | B |
| Beale & Folsom | $N_{crosswalk}$ | 11797 | 2 | 2 | 1 | 18 | 65 | 142 | A |
| | $E_{crosswalk}$ | 8114 | 2 | 3 | 2 | 17 | 11 | 114 | A |
| | $S_{crosswalk}$ | 7959 | 2 | 31 | 1 | 18 | 56 | 142 | A |
| | $W_{crosswalk}$ | 6102 | 1 | 2 | 1 | 18 | 53 | 114 | A |
| Fremont & Mission | $N_{crosswalk}$ | 6924 | 18 | 21 | 17 | 20 | 808 | 9 | E |
| | $E_{crosswalk}$ | 8114 | 18 | 21 | 17 | 18 | 727 | 11 | E |
| | $S_{crosswalk}$ | 7577 | 22 | 19 | 15 | 20 | 805 | 9 | E |
| | $W_{crosswalk}$ | 11951 | 20 | 31 | 23 | 21 | 1073 | 11 | E |
| 1st & Mission | $N_{crosswalk}$ | 11975 | 19 | 11 | 8 | 18 | 490 | 23 | C |
| | $E_{crosswalk}$ | 10739 | 19 | 21 | 17 | 18 | 825 | 13 | E |
| | $S_{crosswalk}$ | 7381 | 21 | 18 | 14 | 17 | 682 | 11 | E |
| | $W_{crosswalk}$ | 5874 | 17 | 18 | 14 | 18 | 652 | 9 | E |

Crosswalk Level of Service Calculation

| **Definition:** | | **Calculation:** |
|---|---|---|
| TS | = available time-space ($ft^2$-sec) | $TS = L_d W_E((WALK+FDW)-L/2S_p)$ |
| L | = crosswalk length (ft) | |
| $W_E$ | = effective crosswalk width (ft) | |
| WALK + FDW | = effective pedestrian green time (s) | |
| $S_p$ | = average speed of pedestrian (ft/s); 3.5 sec | |
| G | = green time for phase (s) | |
| $N_{ped}$ | = number of pedestrians crossing during an interval (p) | $N_{ped} = V_{do}(C-G_c)/C$ |
| v | = pedestrian volume (p/15-min) | |
| C | = cycle length (s) | $t = 3.2+L/Sp+(2.7*N/W_E)$ |
| t | = total crossing time (s) | |
| T | = total crosswalk occupancy time (p-s) | $T = (V_{di} + V_{do})*t$ |
| $V_{di}$ | = inbound pedestrian volume (p/cycle) | |
| $V_{do}$ | = outbound pedestrian volume (p/cycle) | |
| $TS_{TV}$ | = time-space occupied by turning vehicles ($ft^2$-s) | $TS_{TV} = 40*N_{TV}*W_E$ |
| $N_{TV}$ | = number of vehicles during the green phase (veh) | |
| $W_E$ | = effective width of crosswalk (ft) | |
| $TS_E$ | = effective time-space ($ft^2$-s) | $TS-TS_{TV}$ |
| M | = circulation area per pedestrian ($ft^2$/p) | $M = TS_E/T$ |
| TS | = time-space ($ft^2$-s) | |
| T | = total crosswalk occupancy time (p-s) | |

| Average Flow LOS Criteria for Walkways and Sidewalks | |
|---|---|
| **LOS** | **space ($ft^2$/p)** |
| A | >60 |
| B | >40-60 |
| C | >24-40 |
| D | >15-24 |
| E | >8-15 |
| F | ≤8 |

Source: Exhibit 18-3 Average Flow LOS Criteria for Walkways and Sidewalks, Highway Capacity Manual 2000

Corner Level of Service Calculation

| Definition | | Calculations |
|---|---|---|
| TS | = available time-space ($ft^2$-sec) | |
| $W_{a,b}$ | = effective width of sidewalks (ft) | $TS = C(W_aW_b - 0.215R^2)$ |
| R | = radius of corner curb (ft) | |
| C | = cycle length (s) | |
| $Q_{tdo}$ | = total ped waiting time, major street, one cycle (p-s) | $Q_{tdo} = V_{do}R_{mi}^2/2C$ |
| $V_{do}$ | = number of peds waiting, major street, one cycle (p/cycle) | |
| $R_{mi}$ | = the minor-street red phase (s) | |
| $Q_{tco}$ | = total ped waiting time, minor street, one cycle (p-s) | $Q_{tco} = V_{co}R_{mj}^2/2C$ |
| $V_{co}$ | = number of peds waiting, minor street, one cycle (p/cycle) | |
| $R_{mj}$ | = the major-street red phase (s) | |
| $TS_c$ | = total time-space available for circulating peds ($ft^2$-sec) | $TS_c = TS - [5(Q_{tdo} + Q_{tco})]$ |
| M | = circulation area per pedestrian ($ft^2$/p) | |
| $v_{tot}$ | = total number of circulation pedestrians, one cycle | $v_{tot} = v_{ci} + v_{co} + v_{di} + v_{do} + v_{a,b}$ |
| | | $M = TS_c/4v_{tot}$ |

| LOS Criteria for Pedestrian Queuing Areas | |
|---|---|
| **LOS** | **Space (ft2/p)** |
| A | >13 |
| B | >10-13 |
| C | >6-10 |
| D | >3-6 |
| E | >2-3 |
| F | ≤2 |

Source: Exhibit 18-7 Average Flow LOS Criteria for Walkways and Sidewalks, Highway Capacity Manual 2000

Table 3A - PM 2030 No Project - Corner Level of Service Calculation

| Intersection | Corner | Flow, p/15-min | | | | | Flow, P/15 min * 1/60 = p/s | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $Vdi_{major}$ | $Vdo_{major}$ | $Vci_{minor}$ | $Vco_{minor}$ | $V_{a.b}$ | $Vdi_{major}$ | $Vdo_{major}$ | $Vci_{minor}$ | $Vco_{minor}$ | $V_{a.b}$ | $V_{tot}$ |
| 1st & Howard | NEcorner | 27 | 27 | 36 | 21 | 5.55 | 0.12 | 0.11 | 0.12 | 0.10 | 0.02 | 0.47 |
| | SEcorner | 19 | 19 | 21 | 36 | 4.75 | 0.10 | 0.10 | 0.10 | 0.11 | 0.02 | 0.44 |
| | SWcorner | 19 | 19 | 24 | 24 | 4.3 | 0.10 | 0.09 | 0.10 | 0.10 | 0.02 | 0.41 |
| | NWcorner | 27 | 27 | 24 | 24 | 5.1 | 0.10 | 0.10 | 0.10 | 0.08 | 0.02 | 0.41 |
| Fremont & Howard | NEcorner | 18 | 33 | 84 | 31 | 8.3 | 0.10 | 0.09 | 0.16 | 0.12 | 0.02 | 0.47 |
| | SEcorner | 34 | 28 | 31 | 84 | 8.85 | 0.12 | 0.08 | 0.10 | 0.16 | 0.02 | 0.48 |
| | SWcorner | 28 | 34 | 11 | 24 | 4.85 | 0.08 | 0.12 | 0.09 | 0.10 | 0.02 | 0.41 |
| | NWcorner | 33 | 18 | 24 | 11 | 4.3 | 0.09 | 0.10 | 0.10 | 0.10 | 0.02 | 0.39 |
| Beale & Folsom | NEcorner | 18 | 15 | 26 | 9 | 3.4 | 0.04 | 0.03 | 0.04 | 0.02 | 0.01 | 0.14 |
| | SEcorner | 16 | 15 | 9 | 26 | 3.3 | 0.03 | 0.03 | 0.02 | 0.04 | 0.01 | 0.13 |
| | SWcorner | 15 | 16 | 4 | 10 | 2.25 | 0.03 | 0.03 | 0.02 | 0.02 | 0.01 | 0.11 |
| | NWcorner | 18 | 15 | 10 | 4 | 2.35 | 0.03 | 0.03 | 0.02 | 0.02 | 0.01 | 0.12 |
| Fremont & Mission | NEcorner | 143 | 156 | 79 | 172 | 27.5 | 0.27 | 0.28 | 0.25 | 0.32 | 0.06 | 1.18 |
| | SEcorner | 128 | 64 | 172 | 79 | 22.15 | 0.31 | 0.22 | 0.32 | 0.25 | 0.06 | 1.16 |
| | SWcorner | 64 | 128 | 65 | 195 | 22.6 | 0.22 | 0.31 | 0.29 | 0.44 | 0.06 | 1.33 |
| | NWcorner | 156 | 143 | 195 | 65 | 27.95 | 0.28 | 0.27 | 0.44 | 0.29 | 0.06 | 1.35 |
| 1st & Mission | NEcorner | 97 | 55 | 144 | 117 | 20.65 | 0.26 | 0.16 | 0.28 | 0.35 | 0.05 | 1.11 |
| | SEcorner | 67 | 134 | 117 | 144 | 23.1 | 0.29 | 0.27 | 0.35 | 0.28 | 0.06 | 1.26 |
| | SWcorner | 134 | 67 | 148 | 110 | 22.95 | 0.27 | 0.29 | 0.25 | 0.26 | 0.05 | 1.13 |
| | NWcorner | 55 | 97 | 110 | 148 | 20.5 | 0.16 | 0.26 | 0.26 | 0.25 | 0.05 | 0.98 |

Table 3B - PM 2030 No Project - Corner Level of Service Calculation

| Intersection | Corner | R | $W_{a.major}$ | $W_{b.minor}$ | C | $R_{major}$ | $R_{minor}$ | $Q_{tco}$ | $Q_{tdo}$ | TS | $TS_c$ | M | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1st & Howard | NEcorner | 15 | 17 | 15 | 60 | 30 | 35 | 65 | 44 | 12398 | 11854 | 105 | A |
| | SEcorner | 15 | 17 | 17 | 60 | 30 | 35 | 58 | 51 | 14438 | 13892 | 132 | A |
| | SWcorner | 15 | 17 | 17 | 60 | 30 | 35 | 58 | 44 | 14438 | 13930 | 141 | A |
| | NWcorner | 15 | 17 | 15 | 60 | 30 | 35 | 62 | 34 | 12398 | 11918 | 122 | A |
| Fremont & Howard | NEcorner | 15 | 18 | 15 | 60 | 27 | 40 | 68 | 36 | 13298 | 12775 | 113 | A |
| | SEcorner | 15 | 16 | 17 | 60 | 27 | 40 | 64 | 58 | 13418 | 12807 | 110 | A |
| | SWcorner | 15 | 17 | 15 | 60 | 27 | 40 | 97 | 35 | 12398 | 11738 | 120 | A |
| | NWcorner | 15 | 16 | 14 | 60 | 27 | 40 | 83 | 33 | 10538 | 9958 | 105 | A |
| Beale & Folsom | NEcorner | 15 | 26 | 23 | 60 | 34.5 | 26.5 | 10 | 13 | 32978 | 32861 | 1014 | A |
| | SEcorner | 15 | 13 | 19 | 60 | 34.5 | 26.5 | 10 | 25 | 11918 | 11745 | 372 | A |
| | SWcorner | 15 | 14 | 14 | 60 | 34.5 | 26.5 | 12 | 15 | 8858 | 8725 | 323 | A |
| | NWcorner | 15 | 11 | 21 | 60 | 34.5 | 26.5 | 11 | 13 | 10958 | 10836 | 389 | A |
| Fremont & Mission | NEcorner | 15 | 16 | 17 | 60 | 32.5 | 27.5 | 107 | 168 | 13418 | 12042 | 43 | A |
| | SEcorner | 15 | 16 | 17 | 60 | 32.5 | 27.5 | 85 | 134 | 13418 | 12323 | 44 | A |
| | SWcorner | 15 | 15 | 9 | 60 | 32.5 | 27.5 | 118 | 234 | 5198 | 3438 | 11 | B |
| | NWcorner | 15 | 16 | 16 | 60 | 32.5 | 27.5 | 100 | 153 | 12458 | 11192 | 35 | A |
| 1st & Mission | NEcorner | 15 | 17 | 17 | 60 | 28 | 32 | 82 | 137 | 14438 | 13340 | 50 | A |
| | SEcorner | 15 | 17 | 9 | 60 | 28 | 32 | 137 | 111 | 6278 | 5033 | 17 | A |
| | SWcorner | 15 | 17 | 17 | 60 | 28 | 32 | 150 | 101 | 14438 | 13182 | 49 | A |
| | NWcorner | 15 | 17 | 17 | 60 | 28 | 32 | 133 | 100 | 14438 | 13274 | 56 | A |

Table 4A - PM 2030 Project - Corner Level of Service Calculation

| Intersection | Corner | Flow, p/15-min | | | | | Flow, P/15 min * 1/60 = p/s | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $Vdi_{major}$ | $Vdo_{major}$ | $Vci_{minor}$ | $Vco_{minor}$ | $V_{a,b}$ | $Vdi_{major}$ | $Vdo_{major}$ | $Vci_{minor}$ | $Vco_{minor}$ | $V_{a,b}$ | $V_{tot}$ |
| 1st & Howard | NEcorner | 27 | 27 | 36 | 21 | 5.55 | 0.16 | 0.12 | 0.16 | 0.12 | 0.03 | 0.60 |
| | SEcorner | 19 | 19 | 21 | 36 | 4.75 | 0.15 | 0.12 | 0.14 | 0.13 | 0.03 | 0.56 |
| | SWcorner | 19 | 19 | 24 | 24 | 4.3 | 0.14 | 0.11 | 0.13 | 0.12 | 0.02 | 0.52 |
| | NWcorner | 27 | 27 | 24 | 24 | 5.1 | 0.13 | 0.12 | 0.13 | 0.11 | 0.02 | 0.51 |
| Fremont & Howard | NEcorner | 18 | 33 | 84 | 31 | 8.3 | 0.12 | 0.12 | 0.19 | 0.12 | 0.03 | 0.57 |
| | SEcorner | 34 | 28 | 31 | 84 | 8.85 | 0.14 | 0.11 | 0.12 | 0.19 | 0.03 | 0.59 |
| | SWcorner | 28 | 34 | 11 | 24 | 4.85 | 0.11 | 0.14 | 0.13 | 0.12 | 0.03 | 0.53 |
| | NWcorner | 33 | 18 | 24 | 11 | 4.3 | 0.12 | 0.12 | 0.12 | 0.13 | 0.02 | 0.52 |
| Beale & Folsom | NEcorner | 18 | 15 | 26 | 9 | 3.4 | 0.04 | 0.03 | 0.04 | 0.02 | 0.01 | 0.14 |
| | SEcorner | 16 | 15 | 9 | 26 | 3.3 | 0.04 | 0.03 | 0.02 | 0.04 | 0.01 | 0.14 |
| | SWcorner | 15 | 16 | 4 | 10 | 2.25 | 0.03 | 0.04 | 0.02 | 0.03 | 0.01 | 0.12 |
| | NWcorner | 18 | 15 | 10 | 4 | 2.35 | 0.03 | 0.03 | 0.03 | 0.02 | 0.01 | 0.12 |
| Fremont & Mission | NEcorner | 143 | 156 | 79 | 172 | 27.5 | 0.31 | 0.36 | 0.30 | 0.40 | 0.07 | 1.42 |
| | SEcorner | 128 | 64 | 172 | 79 | 22.15 | 0.36 | 0.31 | 0.40 | 0.30 | 0.07 | 1.43 |
| | SWcorner | 64 | 128 | 65 | 195 | 22.6 | 0.31 | 0.36 | 0.34 | 0.52 | 0.08 | 1.61 |
| | NWcorner | 156 | 143 | 195 | 65 | 27.95 | 0.36 | 0.31 | 0.52 | 0.34 | 0.08 | 1.60 |
| 1st & Mission | NEcorner | 97 | 55 | 144 | 117 | 20.65 | 0.31 | 0.19 | 0.32 | 0.40 | 0.06 | 1.27 |
| | SEcorner | 67 | 134 | 117 | 144 | 23.1 | 0.35 | 0.30 | 0.40 | 0.32 | 0.07 | 1.43 |
| | SWcorner | 134 | 67 | 148 | 110 | 22.95 | 0.30 | 0.35 | 0.29 | 0.30 | 0.06 | 1.30 |
| | NWcorner | 55 | 97 | 110 | 148 | 20.5 | 0.19 | 0.31 | 0.30 | 0.29 | 0.05 | 1.14 |

Table 4B - PM 2030 Project - Corner Level of Service Calculation

| Intersection | Corner | R | $W_{a,major}$ | $W_{b,minor}$ | C | $R_{major}$ | $R_{minor}$ | $Q_{tco}$ | $Q_{tdo}$ | TS | $TS_c$ | M | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1st & Howard | NEcorner | 15 | 17 | 15 | 60 | 30 | 35 | 76 | 55 | 12398 | 11747 | 82 | A |
| | SEcorner | 15 | 17 | 17 | 60 | 30 | 35 | 73 | 58 | 14438 | 13783 | 103 | A |
| | SWcorner | 15 | 17 | 17 | 60 | 30 | 35 | 67 | 53 | 14438 | 13836 | 111 | A |
| | NWcorner | 15 | 17 | 15 | 60 | 30 | 35 | 74 | 49 | 12398 | 11781 | 95 | A |
| Fremont & Howard | NEcorner | 15 | 18 | 15 | 60 | 27 | 40 | 96 | 43 | 13298 | 12602 | 91 | A |
| | SEcorner | 15 | 16 | 17 | 60 | 27 | 40 | 91 | 69 | 13418 | 12617 | 90 | A |
| | SWcorner | 15 | 17 | 15 | 60 | 27 | 40 | 110 | 44 | 12398 | 11630 | 92 | A |
| | NWcorner | 15 | 16 | 14 | 60 | 27 | 40 | 96 | 48 | 10538 | 9816 | 79 | A |
| Beale & Folsom | NEcorner | 15 | 26 | 23 | 60 | 34.5 | 26.5 | 11 | 14 | 32978 | 32852 | 956 | A |
| | SEcorner | 15 | 13 | 19 | 60 | 34.5 | 26.5 | 10 | 26 | 11918 | 11735 | 351 | A |
| | SWcorner | 15 | 14 | 14 | 60 | 34.5 | 26.5 | 12 | 16 | 8858 | 8718 | 301 | A |
| | NWcorner | 15 | 11 | 21 | 60 | 34.5 | 26.5 | 12 | 14 | 10958 | 10826 | 362 | A |
| Fremont & Mission | NEcorner | 15 | 16 | 17 | 60 | 32.5 | 27.5 | 135 | 209 | 13418 | 11694 | 34 | A |
| | SEcorner | 15 | 16 | 17 | 60 | 32.5 | 27.5 | 118 | 156 | 13418 | 12047 | 35 | A |
| | SWcorner | 15 | 15 | 9 | 60 | 32.5 | 27.5 | 136 | 275 | 5198 | 3141 | 8 | C |
| | NWcorner | 15 | 16 | 16 | 60 | 32.5 | 27.5 | 115 | 178 | 12458 | 10990 | 29 | A |
| 1st & Mission | NEcorner | 15 | 17 | 17 | 60 | 28 | 32 | 96 | 156 | 14438 | 13176 | 43 | A |
| | SEcorner | 15 | 17 | 9 | 60 | 28 | 32 | 153 | 124 | 6278 | 4891 | 14 | A |
| | SWcorner | 15 | 17 | 17 | 60 | 28 | 32 | 180 | 119 | 14438 | 12942 | 41 | A |
| | NWcorner | 15 | 17 | 17 | 60 | 28 | 32 | 159 | 112 | 14438 | 13082 | 48 | A |